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SWINE HUSBANDRY

Revised by

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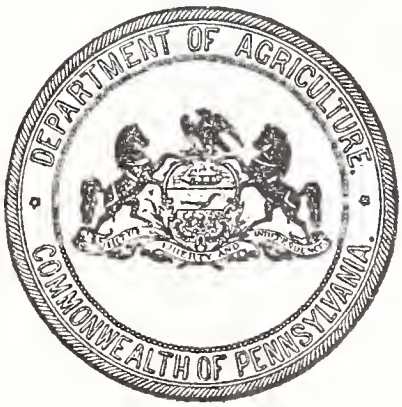

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PREFACE

There has been greater interest in pork production in Pennsylvania during the last few years than usual.

This is partly due to the better recognition of the value of forage crops in reducing the cost of production and partly due to a better appreciation of our many good local markets for pork products. No State in the Nation has more good local markets than Pennsylvania.

In order to further encourage this industry and give help to those already engaged in it, this Department has had Bulletin Number 186 revised and brought up to date, by one whose investigation of the scientific principles underlying the subject, as well as his practical experience, entitles him to the confidence of those who are seeking information, in relation to same.

In revising this Bulletin, the busy farmer's needs have been kept in mind. The discussions have been made as brief as consistent with their relative importance. Scientific terms have been eliminated as far as possible, and discussions made simple and to the point.

CHAS. E. PATTON,
Secretary of Agriculture.

SWINE HUSBANDRY

Revised by Jno. N. Rosenberger, V. M. D.

1918.

THE PLACE OF THE HOG UPON THE FARM.

The swine industry occupies a rather peculiar position in many localities. Swine multiply rapidly and come into use for breeding at an earlier age than other farm animals; consequently, it takes only a short time for farmers to increase or decrease their stock, as the case may be. When, owing to scarcity in the supply of hogs, the price for hogs goes up, we find farmers increasing the number of breeding sows, and in a very short time the supply of hogs coming to market increases to such an extent that the price is likely to break. If the decrease in price is very severe, the farmer becomes disgusted, and the chances are that many farmers will sell their breeding sows and practically go out of the business. This unloading process adds to the burden of the market, and general demoralization is apt to follow. By-and-by, after the market has absorbed the excessive supplies thrown upon it, a scarcity occurs again, owing to so many having gone out of the business of hog raising, and prices once more reach a high level. This is a signal for farmers to rush again into hog raising, and overstock their farms in many cases, so that once more the market becomes top-heavy, and the history of the hog market repeats itself. Now, it is altogether probable that very few of those who were tempted to rush into the business on account of high prices obtained any profit from the venture. They paid high prices for breeding stock, but by the time they had hogs ready for the market, the decline in prices began, and before they were through they were selling their hogs at a loss. The man who makes money out of hogs is the man who has hogs to sell when the prices are high, whose farm is never overstocked, nor yet entirely depleted of its supply. He knows how many hogs his farm will carry to advantage under average circumstances, and he practices a wise conservatism. When prices are high, he has a good profit, when they are low, his profit is small, but the average is fairly satisfactory. He may slightly expand or contract his operations at various times, but he never "plunges."

The "plunger" is apt to find himself "in" when he ought to be "out," and "out" when he ought to be "in." The other man is "in" at all times, but never to such an extent as to be seriously damaged when the market goes wrong.

Generally speaking, the hog may be regarded as a by-product of the farm, or, in other words, he is a means of marketing the by-products of the farm. In the cattle feed lots, we find him utilizing the corn which the cattle have failed to digest and which otherwise would be wasted. In the dairy district, he is the means of obtaining good value for skim milk, buttermilk, and whey. Where mixed farming is practiced, he consumes any dairy by-products, small potatoes, and various other unmarketable substances, and gleans the stubble fields, returning to his owner cash value for substances that are completely neglected on many farms. Even the cottager frequently utilizes him to obtain a cash return from kitchen refuse and table scraps. It is as a consumer of by-products and so-called worthless materials, that the hog shows to the best advantage from the standpoint of profit.

There is also another consideration. The farmer who raises most of his own feed is in a much better position to feed hogs, or any other class of stock, than the man who has to purchase all his feed. The farmer who grows his own feed may not get any more than market prices for the grain, or other produce consumed by the hogs, and may still have a fair profit through selling his produce at market prices in the form of pork; but the man who buys his feed can have for profit only what he obtains in excess of the market value of the foods consumed by the hogs. Thus the farmer who grows his feed has two sources of profit, namely, the grower's profit, or the profit obtained by selling his produce at market price; together with the feeder's profit, or what he obtains for his produce in excess of market price by selling it in the form of pork. The man who has to buy all the produce which he feeds his hogs can have only the feeder's profit, and under unfavorable conditions, this profit may be so small that it will scarcely pay for the labor involved.

Another point worthy of consideration is the fact that under favorable conditions and skillful management young pigs can be raised for feeding at a lower cost than that for which they can be bought. This point will be dealt with more fully in another place, but is mentioned here as one of the factors which help to explain why some people can make hog feeding profitable while others cannot.

One of the great difficulties in connection with the swine industry is the fact that so many people are not content to engage in the undertaking except on a large scale, and the people who can handle hogs in large numbers and make the business a financial success are comparatively few. The average farmer is safer to handle hogs in rather

small numbers, and use them as an adjunct to his other farm operations. Used in this way, and handled with a reasonable degree of judgment, the hog will give a good account of himself in adding to the revenue and the profits from the farm. A very few years' experience should enable a farmer to determine just about how many hogs he can handle to advantage. Some farms will carry very large numbers owing to the system of farming which is carried on, but for many of the smaller farms, one breeding sow is plenty.

The hog fits in especially well upon dairy farms where skim milk, buttermilk, or whey has to be fed upon the farm. Perhaps no animal will give as high returns for dairy by-products consumed, as the hog, and no food gives a finer quality of bacon than dairy by-products. It is also worthy of note that the man who has skim milk is in a better position to raise pigs than the man who has none, for the reason that it is difficult to find a satisfactory substitute for skim milk for young pigs just after weaning.

What has been said in the preceding paragraphs has no reference to the breeding of pure bred hogs for breeding purposes, but applies simply to the production of market hogs. The breeders of purebred hogs understand their business, and know about how far their conditions warrant their extension of their operations, so that it would be out of place to offer suggestions to them along this line. It is true that the breeder of market hogs always has a use for pure blood, but it is not every person who can make a success of breeding pure-breds to supply the demand for breeding stock, and the average farmer is safer to adhere to producing market hogs.

To sum up, it may be said that the hog is especially valuable for consuming the by-products of the farm, and the number of hogs carried to advantage upon a farm is governed very largely by the quantity and character of the by-products to be consumed. When carried in appropriate numbers, the hog is an exceptionally economical producer for meat, preventing waste, and giving cash returns for substances that are frequently wasted, or which have little market value. Trying to take advantage of fluctuating market prices by alternately overstocking and understocking with hogs is seldom a financial success. The man who consistently follows up the business upon conservative lines, is the man who is well satisfied with the hog as a source of profit.

BREEDING AND SELECTION.

The Breeder. The business of the stock-breeder is a peculiar one. He has to deal with life, and all those mysterious possibilities that exist in the living creature have to be reckoned with in his operations.

It is not a matter of fixed rules. No man can map out a system which will apply to all cases, and give a definite result with absolute certainty. The successful breeder requires a thorough knowledge of his business, and the ability to reason accurately, so that he may modify his methods and adapt them to the requirements of each individual problem which comes before him. Knowledge of general principles can be acquired from books, but the successful application of those principles must be learned, very largely, in the school of experience. Theory and practice must go hand in hand, and knowledge must be combined with reason; but the really great breeder seems to possess a sort of intuitive genius, given to the very few, and hence great breeders are not common. Another thing necessary to success is a love for animals. If a man dislikes hogs, he had better not attempt to breed them, because failure is sure to follow. It is the enthusiastic lover of a breed of animals who will make the greatest success in breeding them. Finally, there can be no progress unless the breeder has a very clear ideal before him towards which he is working, which implies, of course, that he must be a thorough judge of the breed he handles. He may never reach his ideal, but he must never lose sight of it. No matter how much money may be invested in the enterprise, it will amount to nothing, unless the breeder has a clearly defined object in view. He will meet with many things to try his faith, but he must not waver; he will be frequently cast down, but he must not despair. Difficulties, disappointments and hope deferred are part of the heritage of the breeder, and he requires the highest class of courage to be able to stick to his guns and eventually bring victory out of what appeared to be certain defeat. There is no "royal road" to success as a breeder, and while there may be a few who attain to greatness, there is no reason why any man should not attain a reasonable degree of success in breeding swine, providing he possesses a liking for these animals, and a determination to conquer the difficulties incident to the undertaking.

Utility. Every breeder should ask himself why he is breeding the animals of his choice. It is to humor the whims of the few, or to meet the demands of the many? If his work as a breeder is to be a success, he must never lose sight of the requirements of the man who produces the market hog for the money that is in it. No matter how pure the blood, or how perfect the type from the breeder's standpoint, if the hog does not meet the requirements of the packer, if it is not suitable to paying the rent and lifting the mortgage when placed in the hands of the average farmer, then all the effort employed in its production has been wasted. The watchword of the truly successful breeder must be utility. Utility is the touchstone upon which each breeder's work will be tested. If his work stands the test, it will surely meet with

recognition, but if it fails in the test it will ultimately disappear and be forgotten. Every step in the breeder's operations must be dominated by this one great consideration, and if he ever loses sight of the importance of utility, he need never hope to achieve lasting distinction as a breeder.

Utility must be viewed from two standpoints. The butcher requires an animal that will give him the largest proportion of valuable meat, and the farmer requires an animal that will reproduce its kind in profitable numbers, and make rapid and economical gains. There would be little use in aiming to please the butcher if the animal did not meet the requirements of the farmer, but the butcher must not be left out of consideration if a really useful animal is to be produced. In breeding operations, therefore, both these men must be kept in view, and the breeding, feeding, and killing qualities must each receive a due share of attention.

Imbreeding. Should be relegated to the most careful study and practice of the breeder of purebred swine and not be attemted by the novice breeding market hogs.

Cross-Breeding. Cross-breeding means the mating of animals belonging to different breeds, and implies that both male and female are pure-bred. Though a good deal of cross-breeding is practiced, very little systematic work has been done in the way of studying the relative merits of pure-bred and cross-bred hogs, nor the best way of crossing to obtain a given result.

The writer's experience leads him to believe that the progeny of animals which have become too fine and lack growth and thrift, can be much improved as profitable feeders by the introduction of the blood of a more growthy and heavier boned type; or that animals that are coarse-boned, or slow feeders, can be improved by using the blood of a finer type. Frequently, however, this result can be attained without resorting to cross-breeding, but by selecting types within the same breed. In the case of thrifty, rugged pure-breds, which are of a type which meets the requirements of the feeder, it is difficult to see how any advantage is to be derived from cross-breeding.

Grading Up. Great opportunity will be found here for improving the herd as well as gaining knowledge in a very convincing way of the principles of breeding. It should be remembered that a sire is more than half the herd. A purebred sire with well recognized characteristics should always be used. The sire should show maximum vigor, come from a prolific dam and show marked growthiness. The great variation of type found in the offspring, with such a cross offers the breeder a great chance for selection; greater than with pure-breds. Here, he should be careful to select for future mating the individuals,

that show marked characteristics of the herd sire. In this way uniformity of type can be had and at the same time intensified vigor, prolificy, and growthiness obtained.

Pedigree and Heredity. A good many people are inclined to look upon pedigree as something distinct from utility. Nothing could be further from the truth. The question is frequently asked: "Which is of greater importance, individuality or pedigree?" The question does not admit of a definite answer, for neither is complete without the other; that is to say, the desirable breeding animal should possess individual merit as well as a good pedigree. The reason we value pedigree is because we believe in heredity. The pedigree tells us the names of the ancestors of the animal in question, and we believe that the ancestors of an individual have an influence in determing the character of the progeny of the individual. Therefore, if we find in the pedigree of a certain animal the names of a considerable number of animals known to possess a high degree of merit, and if the animal under consideration is a reasonably good representative of the breed, we would feel fairly safe in breeding from such an individual. We would say that such an animal had a good pedigree, because it comes of a good line of ancestors. If, however, we found an animal that was quite satisfactory as an individual, but the pedigree showed us names of ancestors which we knew possessed very undesirable qualities, we would hesitate to select such an animal to put into our herd, especially if it were a boar, because we would be afraid that some of those undesirable qualities might crop out in the progeny and be spread throughout the whole herd. We might even go so far as to select a boar not quite equal as an individual to the one just desribed, but possessing a good pedigree. It would not be advisable, however, to breed from a really bad individual merely because he had a good pedigree, because there are many animals with good pedigrees which should never be used for breeding. It is just here where experience is necessary to enable a breeder to hold the balance properly between individuality and pedigree. It may be added that a tabulated pedigree means nothing to the man who does not know anything about the animals whose names appear therein, and the man who would become a breeder must make it his business to familiarize himself with the great sires and families which have attained to eminence in the breed he is handling. It must be remembered, also, that the immediate ancestors such as the sire, dam, grandsire, and granddam, are likely to have a greater influence for good or evil than more remote ancestors, and therefore, the first two or three generations, or, in other words, the top crosses, should receive special attention in studying pedigree. The more remote the ancestor, the less important is its influence likely to be.

Selection of the Boar. In these days, when pure-bred males are plentiful and reasonable in price, there is practically no excuse for using anything but a pure-bred boar, even though the sows may be merely grades. The pure-bred male will transmit his own qualities to his progeny with greater certainty than a grade of cross-bred, and will get pigs of more uniform quality and excellence, so that it pays to use a pure-bred boar even for producing market hogs. It is true that many pure-bred boars should not be used for breeding, but this affords no reason for using a grade boar. The "scrub" pure-bred should be rejected along with the grade and the cross-bred, and there are reasonably good pure-bred boars always available to the man who will make an effort to get one.

When selecting a boar to head a pure-bred herd, it will not do to be too economical in regard to price. This does not mean that we are to pay fancy prices, running into the thousands, such as we sometimes read about, but it is well to bear in mind that a boar which is not good enough to command a fair price, is seldom good enough to put at the head of a pure-bred herd. The importance of the herd will determine the price which the owner can afford to pay for a boar, but a few extra dollars on the price of a boar is a small matter when it is the means of securing something that the breeder really needs. The mere size of the price, however, is not a safe criterion of the merit of the boar, but it rests with the man who makes the selection to see that he gets value for his money. It is right here where a wide experience and a seasoned judgment count for so much in stock breeding. Sometimes aged boars, which have proved their excellence as stock getters, are to be had at a very reasonable price, and if they are still active, they are much safer to buy than young, untried boars. There is much unreasonable prejudice against aged boars, and many an excellent aged boar is sent to the butcher long before his usefulness is past, merely because no person would buy him for breeding purposes; and young boars, many of which should have gone to the butcher before being used at all, are taken in preference. These things are matters of judgment, and to select wisely the breeder must know what he requires.

The desirable conformation of the boar will depend upon whether he belongs to the fat type or the bacon type, and will also be influenced, more or less, by the breed to which he belongs. The general type of the fat hog and the bacon hog is discussed in another place, but it may be said that we expect a boar to be stronger in the head and to possess a more muscular neck, more massive shoulders, and heavier bone, than a sow or barrow. He should conform to the best type of the breed to which he belongs, and should have a

bold, impressive carriage and general appearance. There should be nothing effeminate about his appearance and general make-up. Coarseness and roughness are not desirable, but if it came to a choice between two boars, one of which was fine and effeminate, and the other inclining to coarseness but strongly masculine, the writer's experience would lead him to choose the latter, other things being equal.

Selection of the Sow. For the production of market hogs, it is not essential that a sow should be pure-bred. A grade sow of good type and parentage will usually produce very satisfactory pigs for market purposes, if mated with a boar of good breeding and quality, but, of course, none of her boar pigs should be kept for breeding purposes.

Whether pure-bred or grade, a sow selected for breeding should be from a prolific mother, and by a boar that comes of a prolific family, because fecundity is hereditary to a very high degree. It is safest to select a sow from a matured mother who has had a chance to demonstrate her usefulness. In making a selection, the number and character of the teats should be noted. A sow is more likely to make a good mother if she has at least twelve well developed teats, set well apart, and the front ones well forward on the body.

In character, the sow is directly the opposite of the boar, and there is a femininity about her general appearance and bearing, which indicates the prolific and indulgent mother.

When a really good sow is once obtained, she should be kept in the herd as long as she retains her usefulness. A really first class sow is not too easily obtained, and when once acquired, it will be found the part of wisdom to keep her as long as she continues to produce satisfactory litters.

TYPES OF SWINE.

There are two well defined types of hogs, which are the outcome of local conditions and market requirements, namely, the fat or lard type and the bacon type.

THE FAT OR LARD TYPE.

The fat or lard hog is the product of the "corn belt." Corn feeding has a tendency to produce fat at the expense of the muscle or lean meat, and corn is the principal hog food of the United States. Most of the hogs in the United States are grown in the great corn producing states, and it is here we find the lard type in its highest degree of perfection.

The fat hog is characterized by a compact, thick, deep, smooth body, remarkable for its depth and thickness rather than its length.

There should be a proportionate development of the different parts, and all parts should blend smoothly together, giving what is called compactness of form. The hams, back and shoulders are the most valuable parts from a market standpoint, and should be largely developed. The market hog should be fattened to a high degree, because lard is an important consideration with the packer, and a well fattened hog will dress a larger percentage of its live weight than one which is not well finished, which is another important point with the packer.

Quality is denoted by fine hair, smooth, clear skin, rather fine, clean bone, and even distribution of flesh. There should be no wrinkles in the skin, the jowl should be broad, plump and full but not flabby, and the belly should be reasonably trim, that is, not sagging or baggy, in appearance. In breeding animals, some allowance would have to be made for sows which had produced several litters of pigs.

The animal should be able to walk off freely, without apparent effort, and the pasterns should be short and upright.

The snout should be moderately fine, the face wide between the eyes and the poll wide and full. Width between the eyes and fullness of poll denote a good feeder. The eye should be full, bright, and of good size, and there should be an absence of creases and folds of fat about the eyes. The size and shape of the ear varies in different breeds, but it should be fine, soft, and generally somewhat small. The jowl should be full, broad, deep, smooth and firm, carrying its fullness well back toward the point of the shoulder. The neck should be short and deep, and should blend smoothly into the shoulder at all parts.

The shoulder of the fat hog has considerable market value, and hence should be largely developed. It should be broad, deep, and smooth; compact on top, blending smoothly into the body, and being well covered with flesh over all its parts. The breast should be wide, deep, and full, denoting constitution, and the fore-legs should be set well apart, short, and straight. The pasterns should be upright, the bone rather fine, and clean-cut in appearance, and the feet strongly formed.

Along the region of the back and loin lie some of the most valuable cuts and, therefore, large development is asked for in this region. The back should be broad, straight, or very slightly arched, medium length, uniform width from shoulder to ham, thickly fleshed, even and smooth, without creases or lumps. The loins should be broad, strong, full and thickly and smoothly fleshed. The ribs should be well sprung and the side deep, smooth, and even between shoulder and ham. The heart-girth should be large, the animal being full back of the shoulder, and deep and full at the fore flanks. The hind flank should also be deep and full.

The ham is another important consideration from a packer's standpoint. It should be broad, deep, plump, smoothly and heavily fleshed, with the flesh carried well down towards the hock on the inside as well as at the rear. The rump should be the same width as the back, long, smooth, and slightly rounded from the loin to the base of the tail. The hind legs should be short, straight, set well apart and squarely under the body, with bone, pasterns, and feet as described under the fore-legs.

THE BACON TYPE.

To produce a good side of bacon requires a hog of certain definite peculiarities as to weight, condition and conformation. As a rule, the weight limits are usually fixed at 160 pounds to 200 pounds live weight. As to condition, it is possible to have the hog too thin or too fat. When the carcass is split down the back, the layer of fat along the back should run from an inch to an inch and a half in thickness, and should be as uniform in thickness as possible from the loin to the neck. Most valuable meat in a Wiltshire side is the upper part of the side.

In form, the bacon type of hog is very different from the lard type. It is longer in the leg and body, has less thickness and depth of body, and is lighter in the shoulder, neck and jowl. The hog should be long from the back of the shoulder to the ham, but comparatively short from the back of the shoulder to the snout. Along with length, however, the hog must have sufficient depth and thickness to denote constitution. No matter how long in body it may be, if it has long, coarse legs, and a narrow, cramped chest, it is an undesirable type to breed from. A trim belly is desirable, because the belly meat is cheaper than the upper part of the side. In judging sows that have produced several litters of pigs, some allowance must be made in this connection.

A fine, smooth coat of hair denotes thriftness and good quality of flesh. Wrinkles on the skin, if at all marked, indicate coarse grained flesh. Softness or flabbiness of flesh denotes too much fat in proportion to lean. There is a marked difference between the handling qualities of a finished bacon hog and a finished lard hog, the former being much firmer to the touch. The bacon type of hog has heavier bone than the fat or lard type, but very coarse, puffy looking bone denotes poor quality of flesh and is often associated with poor feeding qualities. Though the bone is fairly heavy, the legs should present a clean-cut appearance.

The jowl has very little market value. A heavy jowl denotes tendency to put on too much fat. Good width of jowl is desirable from a feeder's standpoint, but it should be very trim and neat.

A long, scrawny neck indicates weak constitution and slow feeding qualities. On the other hand, a short, thick neck with an arch, or crest of fat on top, such as is commanded in the fat hog, will cause the side of bacon to be heavy at the shoulder and neck end, and this is the cheap end of a side of bacon. The neck should be of only medium length, and should possess no tendency to arch on top.

The shoulder of the bacon hog is somewhat upright, making the animal comparatively short from the back of the shoulder to the snout, but long from the back of the shoulder to the rump. The shoulder is a cheap part, and, therefore, should be rather light. It should be very compact over the top, should be no wider than the back, and should blend smoothly into the body at all points.

The back carries the most valuable meat, but it should not be wide, because a wide back invariably carries too much fat for a Wiltshire side. It should possess medium width, and should carry its width evenly throughout. The top-line should be slightly arched, the highest point being over the loin.

The spring of rib of a bacon hog is very characteristic. It should spring out boldly from the back bone, then turn sharply and drop in an almost vertical direction, giving a flat, straight side.

From a packer's standpoint, a bacon hog cannot have too long a side, but the breeder must exercise care that he does not secure this extreme length at the expense of constitution. It is well to avoid extremes of all kinds. It is absolutely necessary, however, that the hog should have good length of side, much more than is found in the fat type.

The rump affords a valuable cut, but a flat, broad rump indicates the presence of too much fat. The rump should be the same width as the back, should be very smooth, and slightly rounded from side to side over the top.

Great, broad, bulging hams are not wanted on the bacon hog. Such hams carry too much fat, and require severe trimming in preparing the side of bacon for market. The ham of the bacon hog is smooth and firm, and tapers towards the hock. The flesh should be carried well around the bone, leaving no bareness of bone on the inside of the thigh.

BREEDS OF SWINE.

BERKSHIRE.

Description. The Berkshire is an attractive animal in appearance, and is rather above medium size, though, as a breed, it scarcely equals the Yorkshire and Tamworth in size. The face is moderately dished,

the snout medium in length, the jowl full and rather heavy, and the neck short, with considerable crest. The ears should be firmly attached to the head, and are usually erect, though they frequently incline forward in aged animals. The breed generally has good width of shoulder, a broad back resulting from a well sprung rib, and good thickness through the rump and hams. The Berkshire is noted for a thickly meated, trim ham. In general, it has good depth of body; and should possess a deep, wide chest, with a full heart-girth. In the best representatives of the breed, the bone is all that could be desired, being strong and clean, and the animal generally stands well on its feet. The standard color is black, with white markings in the face, on each foot, and on the tip of the tail. A small splash of white on the arm is not objected to, but when on the jowl, shoulder, or other part of the body, it becomes an objection in the eyes of most breeders. Occasionally, some of the standard white markings are missing, such as the white on the tip of the tail, on one or more of the feet, or the white mark on the face, and the absence of any of these markings would also constitute an objection. The standard of excellence of the American Berkshire Association says nothing about disqualifying an animal for defective markings, so that each breeder must be his own judge as to how much latitude to allow in the matter of markings. Unless the markings are glaringly defective, it would not seem to be the part of wisdom to reject an animal that was really first-class in other respects.

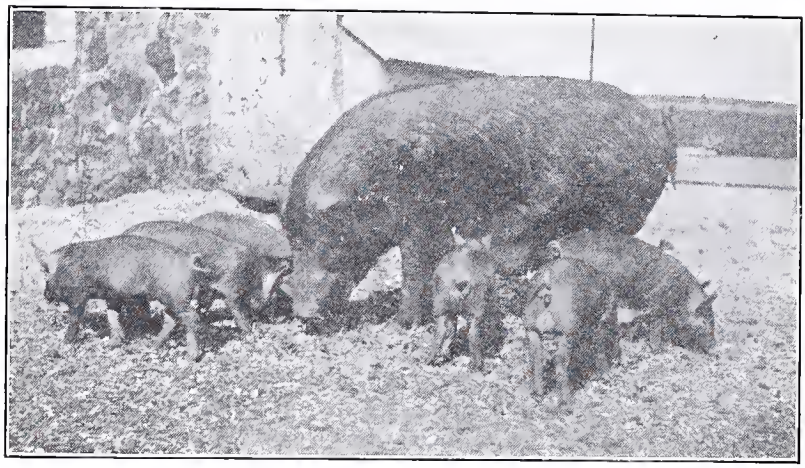
Berkshires are found in every state and territory of the United States, the most important centres being Illinois, Missouri, Indiana, Texas, Ohio, Kansas, Iowa, New York, Michigan, and Tennessee. They are found, also, in every Canadian province, Ontario taking the lead. They are distributed all over the British Isles, and have made their way into South America, Hawaii, and some European countries.

Types. Berkshires vary more or less in type, the type being influenced to a considerable extent by the demands of the market in the countries where they are bred, as well as by the methods of individual breeders. In the United States, it is only natural to expect them to conform to the fat or lard type, and some breeders have gone rather to the extreme in breeding for fine bone, smoothness, and quality, and neglecting size and fecundity. The best breeders, however, are succeeding in maintaining size and quality, and in producing a really useful animal.

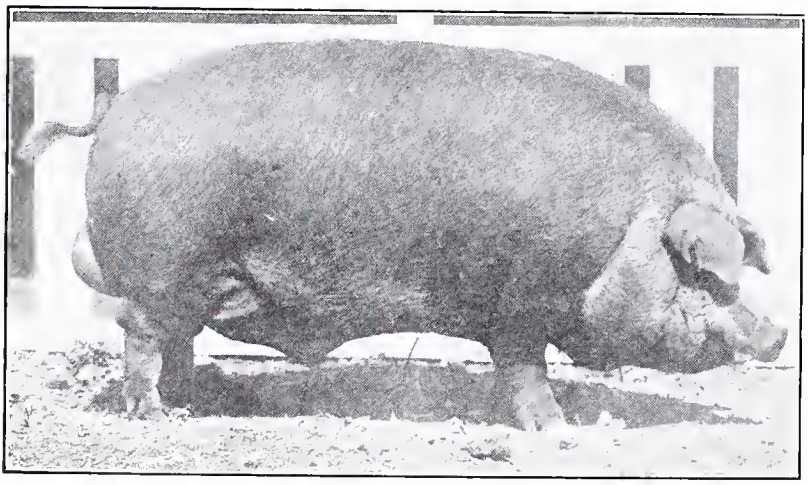
In Canada, the tendency is to select for a lengthy, strong-boned type, which looks somewhat coarse and leggy when compared with the extremely fine type, but which is a first-class farmer's hog. The demand for the bacon type in Canada, and competition with the bacon breeds have an influence in bringing about this modification.

MULE-FOOT.
Courtesy "The Country Gentleman."

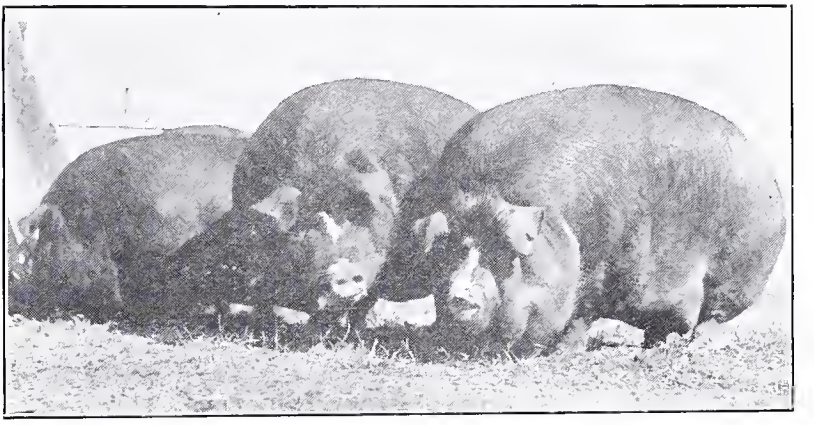
DUROC-JERSEY SOW WITH FAMILY.
Courtesy "The Country Gentleman."



TAMWORTH SOW WITH LITTER.
Courtesy "The Country Gentleman."

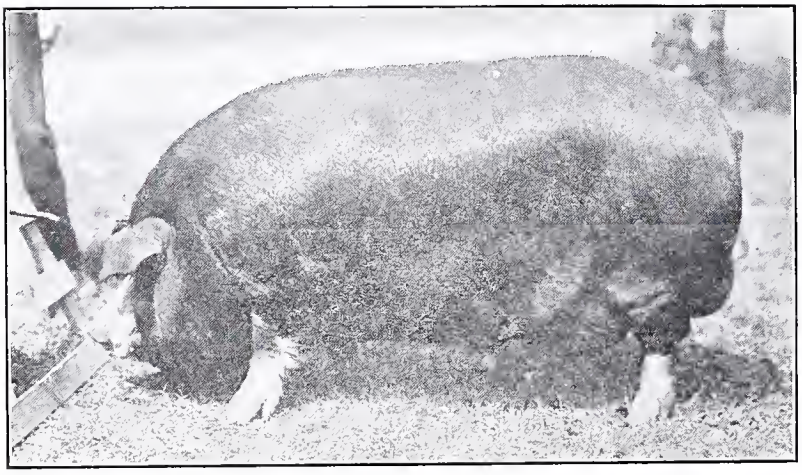


DUROC-JERSEY BOAR.
Note the strong bone.
Courtesy "The Country Gentleman."

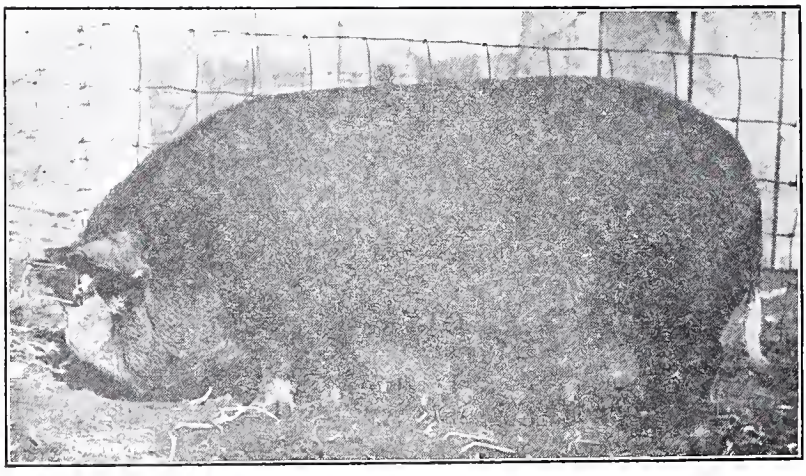


POLAND-CHINA—GOOD MARKET TYPE.
Courtesy "The Country Gentleman."

CHESTER WHITE BRED GILTS.
Courtesy "The Country Gentleman."



POLAND-CHINA BOAR.
805 pounds, 17 months old.
Courtesy "The Country Gentleman."



BERKSHIRE SOW.
Courtesy "The Country Gentleman."

The so-called Large English Berkshire is not a distinct breed, nor is it necessarily a distinct family or branch of the breed. In England, as in any other country, the Berkshire will be found to vary more or less in type, and some importers select the larger, stronger-boned animals and import them under the name of Large English Berkshires. As a matter of fact, some of them may be litter mates of animals of the fine-boned type.

Utility. The Berkshire is better suited for supplying the market demand for fat hogs than it is for producing bacon hogs. Where backs, shoulders, and hams are the main requirements, the Berkshire fits in exceptionally well, but for the export bacon trade in "Wiltshire sides," it has scarcely enough length of side, and has too heavy a neck and shoulder. When crossed with the Large Yorkshire or Tamworth, an excellent farmer's hog is the result, though perhaps it is a little nearer the bacon type than the fat type. Berkshires have given a good account of themselves in the market classes of leading exhibitions where they have come into competition with other breeds.

In early maturity, Berkshires stand well, attaining good weights at an early age and fattening readily. Some would place the Poland China ahead of the Berkshire in point of early maturity, while others would place the Chester White or Duroc Jersey at the head of the list; but it is probable that among the best representatives of the breeds mentioned, there is not any very marked difference in point of early maturity.

The Berkshire ranks with the best as an economical producer of pork. Probably it will never be known which breed is capable of making the cheapest gains, but it is safe to say that the Berkshire will produce pork as cheaply as any other breed.

The flesh of the Berkshire is of excellent quality, and carries a large proportion of lean to fat. Investigations regarding the quality of meat from different breeds generally agree in giving the Berkshire a high place.

Berkshire sows of the more lengthy type are prolific, and generally make good mothers, but the extremely fine, short type of sow seldom produces such large litters. The boars are prepotent, and cross well with almost any other breed, as well as being useful for improving common stock.

POLAND CHINA.

Description. In size, the Poland China is generally ranked as medium, and, as a breed, it would probably hardly average up with the Berkshire in size, though it cannot be said that there is much difference between the two breeds in this point. The face is practically straight, and the jowl full and heavy. The ears should be fine

and firmly attached, with the tip drooped, the droop taking in about one-third of the length of the ear. Ears that are loosely attached and droop right from the point of attachment are seriously objected to. The shoulder is heavy, and the side, which is somewhat short, is very deep. The back is wide, and the top-line very slightly arched. The hind quarter is heavily fleshed, and the ham should be exceptionally wide and deep. As a rule, the legs are very short, and the bone fine—too fine in some cases. Years ago, Poland Chinas were freely marked with white, but the fashionable color today is practically the same as that of the Berkshire, namely, black with white on face, feet, and tip of tail. A limited number of small white markings on other parts are not seriously objected to.

Types. The older type of Poland China was a larger, more rangy, and heavier boned hog than the Poland Chinas seen in the show-rings of to-day. Breeders of Poland Chinas have rather gone to the extreme, on the whole, in the matter of selecting for fineness of bone, and the result, in many cases, is a hog that lacks somewhat in size and fecundity. At the present time, the advisability of developing more size and bone in the breed is being widely discussed in the public press, and thoughtful breeders will give the matter careful consideration. There is little doubt that the best breeders will succeed in maintaining quality without sacrificing utility, and that the overfine type will fall into disfavor with the general farmer.

Utility. The Poland China has been developed especially to meet the market demand for a fat or lard hog. The heavy shoulder, wide back, and largely developed hams render it an exceptionally good yielder from the packer's standpoint.

A cross between the Poland China and the Berkshire, Duroc Jersey, or Chester White is generally highly esteemed, and many regard the cross-breds as superior to the pure-breds for feeding.

As to early maturity, or the ability to produce a finished fat carcass for the butcher at an early age, no breed excels the Poland China. It has been bred for early maturity for generations, and has acquired a high reputation in this regard.

The Poland China is a general favorite with corn-belt farmers. It has been developed upon corn-feeding, and will probably stand heavy corn-feeding better than most other breeds. As a machine for turning corn into pork, it is hard to beat, and it is also a good grass hog.

The meat of the Poland China has been criticised freely for carrying too large a proportion of fat to lean, and there seems to be good ground for the criticism. In their efforts to bring the breed to its present stage of perfection as a feeder, breeders have overlooked the

production of lean along with fat, but the breed seems to meet the demands of the American packer, and he is willing to pay top market price for it.

Since so much attention has been paid to the development of the fine bone and a marked tendency to fatten in this breed, it is not surprising to find it criticised as lacking in fecundity. Statistics appear to indicate that the Poland China is not up to the average of other well-known breeds in point of fecundity, the deficiency occurring mainly in the very fine-boned types. This point gives the breeder of Poland Chinas food for serious reflection.

Owing to its exceptional tendency to fatten, the Poland China is valuable for crossing upon hogs which lack this tendency, and it is a useful breed for improving the common stock of the country.

CHESTER WHITE.

Description. At one time the Chester White was rated as the largest breed in the United States, but the tendency of modern breeding has been towards the production of a finer-boned, smoother, and smaller animal than the older type, and at present the Chester White is similar to the Poland China in size, though it is commonly claimed that it is a larger breed. The face is straight, and the snout is usually a little longer than that of the Poland China. It has a drooped ear, similar to that of the Poland China, but the droop, or break, is usually further from the tip. As a rule, too, the ear is somewhat heavier, and it is quite common for it to be somewhat loosely attached. In general conformation, the Chester White is similar to the Poland China, though the latter generally excels in depth and fulness of ham, and many Chester Whites are rather longer in the body than the Poland Chinas. The color is white, no black hair being admissible, though it is common for black or bluish spots to occur on the skin. These spots do not indicate impurity of blood, but breeders aim to avoid them as much as possible, and if the spots are large or numerous, they constitute a serious objection. In many specimens, the hair has a tendency to be wavy, and in some cases it is almost curly.

Types. The Chester White seems capable of showing more extreme variations of type than most other breeds. In the show-rings of the United States, the short-legged, fine-boned, smooth, medium-sized type seems to be preferred by most judges, who seem inclined to discourage the larger and heavier boned types. In Canada, more attention is paid to length, and some very lengthy, heavy-boned Chester Whites are met with sometimes in Canadian show-rings. In 1907, at the Ontario Provincial Winter Fair, held at Guelph, Canada, a pair of Chester White carcasses won sixth prize in the bacon carcass competition, where they had to compete with Yorkshires, Tamworths,

and Berkshires. Though they did not make ideal carcasses from a bacon standpoint, quite a number of Yorkshire and Tamworth carcasses, together with all the Berkshire carcasses, were ranked below them. When it is known that the Guelph fair has the largest exhibit of bacon carcasses on the continent, it is easy to understand that these Chester Whites must have been about as different from the type of the American prize-winning Chester White as it was possible for them to be. This is an extreme case, but it illustrates the possibilities of the breed under different systems of selection and feeding.

Utility. Though the Chester White can be made to approach the bacon type through selection and feeding, it seems like a waste of energy to attempt to make it a bacon breed, when first class bacon breeds are available already. The Chester White is best adapted to the requirements of the fat hog trade, and no doubt will continue as such. In Canada, it is frequently crossed with the Yorkshire and Tamworth, giving a very satisfactory feeder's hog. In the United States, a cross between the Chester White and Poland China is very popular. In fact, the breed crosses well with almost any other, and the Chester White boar is very effective in improving common stock.

The Chester White compares favorably with other breeds in early maturity, and as an economical producer of meat. It is also a good grazer, but, like other white breeds, is more or less subject to skin trouble when exposed to all kinds of weather. It produces a good quality of meat, which, however, is rather lacking in lean.

It is claimed that the Chester White, as a breed, is somewhat more prolific than the Poland China and the fine type of Berkshire, and the claim is supported by the findings of Dr. A. W. Bitting, who investigated the matter in 1897.

DUROC JERSEY.

Description.—The Duroc Jersey is similar to the Chester White and Poland China in size, the tendency of modern methods of breeding being towards a medium-sized hog with rather fine bone. The snout is of medium length, the face slightly dished or straight, and the ear drooped, much the same as that of the Chester White. The jowl is heavy, the body wide and deep, and the ham heavily fleshed. The legs are short, the bone medium in weight, and the body is noted more for thickness and depth than for length. Cherry red is the popular color, but yellowish red and chestnut are often seen. A few black spots on the belly and legs do not disqualify, but are objectionable. Black markings on any other part of the body are very serious objections.

Types.—Considerable variation is found in the type of Duroc Jerseys, as is also the case with other breeds. It is claimed by some, that breeders have gone too far in their efforts to produce a fine-boned,

smooth animal, in that they have sacrificed too much of size and fecundity in doing so. Be this as it may, breeders are to be found who are producing hogs of more bone and greater size, and their hogs are attracting considerable attention among those interested in the breed.

Utility.—The Duroc Jersey is essentially of the fat or lard type, and it seems to be meeting the demands of the American packer in a satisfactory manner. It is an early maturing hog, and is capable of making cheap gains. In this respect, it is probably quite equal to other breeds. It has a good reputation as a grazer, and also thrives well upon a corn diet. It has an advantage over white breeds, in that its skin does not blister with the sun, a fact that is causing it to gain in favor in the South. Its meat is similar in quality to that of the Poland China and Chester White, when fed under similar conditions.

For a fat hog, the Duroc Jersy is prolific, and it crosses well with other breeds, especially the Berkshire and Poland China. As improvers of common stock, the boars bear a good reputation.

HAMPSHIRE (THIN RIND.)

Description.—The Hampshire belongs to the class of medium-sized hogs. The face is straight, and the ear inclines forward but does not droop like that of the Poland China. The jowl, shoulder and ham are somewhat lighter than those of a typical fat hog. As a rule, too, it has less width of back, a little more length of side, and slightly less depth of side than a hog of the strictly fat class. The breed may be described as somewhere between the bacon type and the fat type in conformation.

Mr. H. F. Work, at one time secretary of the Breed Association, describes the color as follows: "In color, they are either listed or blacks, the most fashionable color consisting of black extremities with a white belt from four to twelve inches wide, encircling the body and including the fore legs, which should also be white." The term "listed" refers to the presence of the white belt. Mr. Work also states that there are some breeders who try to run their herds all black, and he claims that breeders should not be too particular regarding color, with the exception that white spots should not be tolerated.

Types.—Though Hampshires may vary in color, they appear to be quite uniform in general type. Possibly, as the breed becomes more numerous and better known, variations in type may become more apparent.

Utility.—It is generally claimed that the Hampshire is a bacon hog, but, in this connection, we must bear in mind that what the

American packer calls a bacon hog is very different, as a rule, from the hog which is suitable for making Wiltshire sides for export to Great Britain. Judged from the standpoint of suitability for making export Wiltshire sides, the Hampshire falls far short of requirements, as it is too short in the side, too thick in the shoulder and back, and too heavy in the neck to make a really good Wiltshire side. Inasmuch as the terms "bacon hog" and "bacon type" have been used throughout this treatise to apply only to hogs suitable for supplying export Wiltshire sides, we prefer not to class the Hampshire as a hog of bacon type, though it is well suited for supplying bacon for home consumption.

In quality of flesh, the Hampshire has a high reputation. It has made a good record in the dressed carcass competition at the International Livestock Exposition at Chicago, and the packers appear to hold it in high esteem. Its flesh carries a high per cent. of lean, and is generally fine-grained.

In early maturity and feeding qualities, the Hampshire seems to be giving good satisfaction to those who are handling it, and it is highly esteemed as a grazer. It is an active, hardy breed, and there is no apparent reason why it should not give as good an account of the food it consumes as any other breed.

The Hampshire ranks high in point of fecundity, and is one of the most prolific of American breeds. Its value for cross-breeding is not well known, but it seems reasonable to suppose that it should cross well with the fat types of hogs.

LARGE YORKSHIRE (OR LARGE WHITE).

Description.—The Large Yorkshire is one of the largest of the breeds of swine. The face is slightly dished, and the snout should be of medium length and practically straight. "Turned-up" snouts, which were common at one time, are not popular with Large Yorkshire breeders at present. The jowl should be of good width and muscular, but not flabby nor heavily loaded with fat. The ears are large, and sometimes incline forward, especially in old animals, but an erect ear, firmly attached to the head, is preferred. The ear should not be coarse, and should be fringed with fine hair. The shoulder and back are of only medium width, the side is long, and the ham carries very little surface fat, making it lighter than the ham of the fat or lard hog. The ham generally has a tapering appearance toward the hock, and should be well fleshed on the inside of the thigh, but there should be no wrinkles or flabbiness. The bone is fairly heavy, but should be clean-cut in appearance, and the leg is longer than the leg of a fat hog. The color is white. Black hairs should disqualify, but

black or blue spots on the skin do not disqualify. The aim of the breeders is to reduce these skin spots to a minimum, and they object seriously to an animal which shows considerable patches of dark colored skin.

Types.—Large Yorkshires are inclined to vary more or less in type, and it requires skill in selection to keep them true to the best type. It used to be quite common to find short, turned-up snouts among representatives of the breed, but since this style of snout is commonly associated with a heavy jowl, neck and shoulder, the best breeders are striving to eliminate it. Another type sometimes met with has a long, scrawny neck, narrow chest, and long, coarse-boned legs. This type generally has plenty of length and a smooth shoulder, but it is apt to be a slow feeder, and possesses too much bone and too thick a skin, together with a lack in quantity and quality of flesh. The best type of Large Yorkshire has sufficient length to make a good Wiltshire side, and has constitution and quality to such a marked degree that it is unexcelled from a feeder's standpoint. Generally speaking, American breeders incline towards a rather shorter and thicker type than is popular with Canadian breeders.

Utility.—The Large Yorkshire is highly valued for bacon production, where a long side abounding in lean meat, and a light shoulder and neck are especially desirable. For quality of bacon, it is rivalled only by the Tamworth. The large proportion of lean to fat, the thick, fleshy belly, and great length of side, render the breed peculiarly desirable from the bacon curer's and the consumer's standpoint. At the Ontario Provincial Winter Fair, held annually at Guelph, Canada, Large Yorkshires and their grades always take a prominent place in the bacon carcass competition, and carry off a large share of the prizes.

The Large Yorkshire is spoken of quite commonly as being slower in maturing than the fat types of hogs, but this is not a fair way of stating the case. From a bacon curer's standpoint, Large Yorkshires will reach desirable market weight and condition at as early an age as any existing breed, and there are few breeds which equal them in this respect. Therefore, so far as the farmer who is feeding hogs for the export bacon trade, is concerned, no breed excels the Large Yorkshire in point of early maturity. For the production of a very fat carcass at an early age, the Large Yorkshire is not so well adapted as the fat or lard types. It is a special purpose breed, and for that special purpose will mature just as early, or earlier, than almost any other breed.

From the fact that it grows rapidly and develops bone and muscle more rapidly than it forms fat, feeders are inclined to regard the Large Yorkshire as an expensive hog to feed, but experiments go to

show that such is not the case, and that, under most circumstances, it is capable of giving as large gains for food consumed as any other breed. Probably it is not so well adapted to grazing as some other breeds, and a hot sun is apt to blister its skin. It is possible, too, that it would not thrive so well as some other breeds upon an exclusive corn ration. Where a mixed ration is used, and especially where pen feeding is practiced, it gives a good account of the food it consumes.

The large size and the strong bone of the Large Yorkshire, making it valuable for crossing upon breeds that have become unduly fine in the bone and that lack size. It crosses well with almost any of the fat breeds, increasing the size and the proportions of lean without injuring the feeding qualities. Large Yorkshire sows are prolific, and are good nurses, and the boars are exceptionally prepotent, stamping their character and color upon their progeny to a remarkable degree, no matter what they are crossed with.

TAMWORTH.

Description.—The Tamworth ranks with the Large Yorkshire in size. It has a rather long, straight snout, and usually has little or no dish to the face. The ear is large, firmly attached, generally inclined slightly forward, and fringed with fine hair. The ear should be quite thin, and it is rather more pointed than that of the Large Yorkshire. The Tamworth has a very light jowl, and a light neck and shoulder. The back and loin are of medium width, and the side of good length, but only of moderate depth as compared with a fat hog. Quite commonly, the ham is deficient, and breeders are making an effort to strengthen this point. The bone is fairly heavy, and the leg looks long compared with that of a fat hog. According to the standard of the National Pig Breeders' Association of Great Britain, the Tamworth should have "golden red hair on a flesh colored skin, free from black," but the shade of red varies considerably in individuals, and a chestnut shade is quite common. The color generally grows darker with age, and the color of some aged animals is such a dark shade of chestnut that the casual observer might easily mistake it for a dull black.

Utility.—The Tamworth is especially adapted to the production of export bacon, or a class of bacon which carries a large proportion of lean to fat. In early maturing qualities, it is similar to the Large Yorkshire, producing a bacon carcass fit for export at as early an age as any other breed, but for producing a fat carcass at an early age, the Tamworth is not so well suited as some other breeds. For bacon production, therefore, the Tamworth matures early, and it is from the bacon standpoint that this breed must always be judged.

There is a popular belief that the Tamworth does not make economical use of food, but experimental work shows that this belief is not well founded, and that the Tamworth compares very favorably with other breeds as an economical producer of meat. Like the Large Yorkshire, it is probably rather better adapted to pen feeding than to pasturing, but its ability to stand heavy corn feeding is practically unknown.

It is claimed by its admirers that the Tamworth produces higher class bacon than any other breed, but where it has come into competition with Large Yorkshire in dressed carcass competitions, the Large Yorkshire has carried off the larger share of the prize money. There is no question, however, that the Tamworth produces bacon of exceptionally fine quality, well mixed with lean, and fine in the grain. The Large Yorkshire and the Tamworth are the only strictly bacon breeds with which we are familiar in America.

Being a large breed with strong bone, the Tamworth is suitable for crossing upon finer and fatter breeds, and is very popular for this purpose where it is best known. The boars are prepotent to quite a marked degree, and the sows are good mothers, being prolific and good nurses.

VICTORIA.

Description.—The Victoria is a medium-sized breed, being similar in size to the Berkshire. It has a rather short snout, dished face, and a medium-sized, erect ear which is firmly attached to the head. The jowl is full, the neck short, the shoulder wide, the body broad and deep, and the ham well developed. The legs are short, and the bone rather fine and of good quality. The color is white, with occasional dark spots on the skin.

Utility.—The Victoria belongs to the fat class of hogs. There seems to be a dearth of experimental data bearing upon the early maturity and feeding qualities of the Victoria, but the fact that it has not gained more rapidly in popularity would indicate that farmers do not think that it possesses any advantages over other breeds. The quality of the meat is said to be good, and the breed also bears a good reputation for being prolific. The value of the breed for crossing purposes is not well known.

CHESHIRE.

Description.—The Cheshire is about medium size, but some specimens attain heavy weights. It is claimed that the Cheshire weighs well for its appearance, and that it is a heavier breed than is generally supposed. The face is slightly dished, and the ear rather small and erect. The bone is fine and of fair quality. The body is not noted

for depth, but usually has good length, and the shoulder and hams are generally well developed. The color is white. Black spots on the skin are objectionable, but do not disqualify.

Types.—In his letter to Mr. Coburn, previously referred to, Mr. Sanders states that in his herd he has produced "all the different types of Yorkshire, from the Large Yorkshire down to the Lancashire Short-face." As bred at present, the type probably does not vary in Cheshire any more than in other breeds.

Utility.—The Cheshire, as generally seen, belongs more to the fat than to the bacon class, though it should not be difficult to develop it into a fairly good bacon breed. It appears to be a good feeder, and its meat is admitted to be of excellent quality. The sows are fairly prolific, and the boars appear to be prepotent, but very little is known regarding their value for crossing.

ESSEX.

Description.—The Essex belongs to the small breeds, being decidedly smaller than such breeds as the Berkshire or Poland China. The snout is short, the face slightly dished, the forehead broad, and the ears small, fine and erect, but inclined to droop slightly with age. The jowl is heavy, the neck very short, and the bone fine, and the pig as a whole is compact, smooth, short, thick and chunky. The color is all black, no white being admissible.

Types.—To meet the modern demand, many breeders of Essex swine are striving to develop a type with more size, heavier bone and greater length. Judging by some of the exhibits at fairs during recent years, this effort is meeting with some success and Essex pigs are to be seen which give more promise of present day utility than the older type.

Utility.—The Essex belongs to the quick maturing kind, and is easily kept fat. Its lack of size prevents it from becoming popular with the general farmer, and it is perhaps better suited to the requirements of the cottager, who wishes to keep a pig with a minimum outlay for feed. He does not have so many pounds of pork, but he has a fat hog with a small outlay. It has never been demonstrated that the Essex requires less food for a pound of gain than other breeds, but there is no doubt that it is an economical producer of meat. The meat is fine grained, but excessively fat.

SUFFOLK.

Description.—The Suffolk is a small breed. The face is dished, the snout small and very short, the ears short, small, thin, upright, soft and silky, the neck very short, and the body thick, short and smooth, set upon very short, fine-boned legs. The hair should be fine and silky, and of a pale, yellowish white color. The skin is of a pinkish shade, and should be entirely clear of dark spots.

Utility.—What has been said regarding Small Yorkshires under this heading, applies to the Suffolk as well, since the breeds are very similar.

SMALL YORKSHIRE.

Description.—The Small Yorkshire may be termed the smallest breed in the United States. It has a very short, turned-up snout; wide face, small, erect ears, heavy jowl and a very short neck. The body is short, thick, deep and smooth and the legs are very short and very fine in the bone. The color is white and the hair is abundant but fine.

Utility.—There does not seem to be any very important place for the Small Yorkshire to fill in America. The breed matures early and fattens easily, but produces excessively fat meat. Like the Essex, it is probably most suitable for the cottager who wants a pig that can be matured with a small amount of feed. There is no American breed that requires crossing with a breed like the Small Yorkshire, unless it is the "Razorback," and the Essex seems rather adapted to this purpose, as its skin will stand the hot sun of the South better than that of a white breed. The Small Yorkshire is not noted for fecundity, and unless some unforseen conditions arise, the breed seems destined to gradually disappear.

MULE-FOOT HOG.

Description.—A marked peculiarity of the Mule-Foot Hog is its solid hoof, and from this peculiar feature the breed takes its name. In general conformation, it is claimed that the Mule-Foot Hog is between the fat type and the bacon type, but it is not noted for great length of side. The color is black, but white points are admissible. More white than black is a disqualification, and any considerable amount of white is regarded as objectionable.

Origin and History.—The National Mule-Foot Hog Record Association, which has its office in Indianapolis, has issued the following statement:

"Up to the present date, the Mule-Foot Hog is a hog without an authentic history. Rumors and reports offer Denmark, Holland, South Africa, Mexico, South America and the Sandwich Islands as the country of his birth. * * * Reports are so contradictory that this Association cannot, without further research, endorse any of them. Every effort will be made by the Association to discover the origin of the Mule-Foot Hog, and to furnish its friends with a true and complete history."

So far, animals of this breed are not numerous nor widely distributed. Indiana, Missouri, Arkansas, Texas, and Louisiana are

probably the principal states for the breed, but the breed is not largely represented in any state as yet.

Utility.—The National Mule-Foot Hog Record Association makes the following claims for the breed:

"As to the special qualifications and fine points of the Mule-Foot Hog, we know it to have greater vitality than any other breed in the United States. We have never known a full blood Mule-Foot Hog to have hog cholera. It is an easy feeder, develops early and rapidly, is in strong demand on the market at a premium. * * The sows are good, gentle mothers and raise large litters of pigs, which if turned out, will hustle for a living, or they will grow fat and thrive, paying big returns, under good care and attention."

It must be remembered that the claims set forth above are made by admirers of the breed. So far as can be learned, these claims have not been tested by independent investigators.

EXPERIMENTS IN SWINE FEEDING.

It is out of the question to review in detail all the work of experiment stations in swine feeding, but there are certain phases of the work which may be dealt with profitably in a somewhat general way. The problems which face the swine feeder are numerous, and the experiment stations have been working for years to find solutions for some of them. To solve any problem in stock feeding is a tedious matter, because animals differ so much individually in their ability to utilize food, that it requires many repetitions, and the employment of large numbers of animals to answer an apparently simple question. Great care is necessary, therefore, in interpreting the results of livestock experiments, and it will not do to draw general conclusions where only a limited amount of work has been done.

INFLUENCE OF FOOD UPON THE BODY OF THE PIG.

Prof. Henry in his excellent book, "Feeds and Feeding," gives an account of work done along this line by Sanborn at the Missouri Agricultural College, Henry at the Wisconsin Experiment Station, Shelton at Kansas, Duggar at Alabama, and Fortier in France.

Corn, which is the standard hog food of the United States, is a food rich in carbohydrates, or fat-forming constituents, but rather low in protein, or muscle-forming constituents. It is also low in ash, or bone-forming material. The question arose, therefore, whether a food such as corn would not have a tendency to produce more fat in the body of a hog, than would foods which contain a higher percentage

of protein and ash. Without going into details, it may be said that corn was fed in opposition to mixtures containing such foods as dried blood, wheat middlings, peas, skim milk, bran, and cow peas, which are foods much richer than corn in protein.

The methods employed in the investigation varied somewhat, but the general results were as follows:

The pigs fed the protein-rich ration generally dressed a somewhat lower percentage of their live weight than those fed the corn ration.

In nearly every case, the pigs fed the protein-rich ration had the largest quantity of blood, and in every case they had heavier livers than the others. Their kidneys were also heavier, as a rule, though there were some exceptions.

In the Wisconsin and Kansas experiments, the tenderloin muscles were removed and weighed, and in both cases, these were heavier in the case of the protein-fed pigs. The tenderloin muscle is an indication of the amount of lean throughout the carcass, and hence it was demonstrated that the carcasses of the protein-fed pigs contained more lean than the others.

As a rule, the corn-fed pigs gave more leaf lard than the others.

At Wisconsin and Kansas, the breaking strength of the thigh bones was tested by a machine designed for such purposes, and in every case the bones from the pigs fed the mixed ration proved stronger than those of the corn-fed pigs, the difference being as high as 32 per cent. in one trial.

Though the experiments described demonstrate very clearly that it is possible to modify the carcass of the pig by a judicious selection of foods, we must not assume that lean meat or fat can be developed to any extent which the feeder may desire. Nature has set a limit in this connection, and what may be accomplished by the feeder in the way of developing lean meat, cannot go beyond a certain point. The theory that any breed of hogs can be feed in such a way as to produce choice bacon for the English market is not borne out by these, or other experiments, nor by the experience of practical breeders who really understand the demands of the market.

A peculiar feature of swine is their tendency to develop fat. If the very best specimens of the bacon type are fed largely upon corn, they quickly assume the fat or lard type, and in one or two generations of such treatment the tendency to become shorter in side and thicker in body become so firmly fixed that it is very difficult to change them back to the bacon type again under any system of breeding and feeding. On the other hand, breeders of bacon hogs know that it requires careful selection and feeding to maintain the type. Even under the most favorable conditions, there is a tendency for the bacon type to change gradually in the direction of the fat type, unless care is exercised in selection. It is safe to say, therefore,

that it is easier to increase the proportion of fat in a hog's carcass, than it is to increase the proportion of lean, and that the extent to which the lean may be increased by the character of the food is very limited, and is fixed by the individuality of the animal. Further, any attempt to increase the amount of lean through feeding, must be started when the pig is very young in order to be successful.

THE SELF-FEEDER.

(See Page 93).

The self-feeder properly constructed, will help solve many feeding problems.

The pig can balance his own ration, taking the various ingredients from a self-feeder, is an undisputed fact. For growing and fattening stock the self-feeder will be found valuable. For breeding stock it is difficult to mix a ration of such character, so as not to over-fatten brood sows, when allowed free access to the self-feeder, at all times. Feeders work best when breeding stock is given the run of a good pasture.

During the first week that pigs are put on the self-feeder they are likely to overeat but soon they adjust their appetites and take more freely to the forage crops, in the pasture lot.

Plenty of fresh water should be supplied where self-feeders are used, especially where highly concentrated protein feeds are fed like tankage or meat meal.

POUNDS OF PORK FROM BUSHEL OF CORN.

As in nearly all livestock investigations, wide variations have occurred in connection with this apparently simple problem. Farmers have been asked to report results through the agricultural papers, and numerous results have been obtained from experiment stations. Prof. Robbins of the Iowa Experiment Station presents a very concise summing up of the question in the columns of "The Breeder's Gazette," where he gives the following table:

	Number of tests.	Number of hogs.	Number of days fed.	Average weight of hogs at start.	Gain per day.	Corn for 100 pounds gain.	Gain per bushel of corn.
				Lbs.	Lbs.	Lbs.	Lbs.
Farmers,	8	322	56	157	1.09	544	10.3
Experiment Station,	18	144	79	149	1.09	546	10.2
Farmers and Experiment Stations,	26	466	68	153	1.09	546	10.25

The results given in the table are from tests where only whole corn was fed, no supplementary foods or pasture being used. The results from farmers and experiment stations agree very closely, and confirm the general belief that hogs on full feed of whole corn should gain about one pound per day, and make ten pounds of pork from a bushel of corn. This is not a large return from a bushel of corn, but the method of feeding is not the most economical.

WHOLE CORN vs. GROUND CORN.

The Wisconsin Experiment Station has conducted exhaustive experiments with whole corn and ground corn for fattening swine. The experiments extend over a period of ten years. Eighteen separate tests were made, in which a total of 280 pigs were used. Bulletin 145 gives a summary of the results.

The feed required to produce 100 pounds of gain varied from 360 pounds to 820 pounds, the poorest gains being made in the case of young pigs, weighing 84 pounds when the trial began, which were fed upon corn alone, and the best gains for food consumed were made by young pigs which were fed equal parts by weight of corn and middlings with a small allowance of skim milk.

The 140 pigs fed ground corn ate 5,510 pounds more grain and made 2,036 pounds more gain than the 140 pigs fed whole corn.

The pigs fed whole corn consumed an average of 501 pounds of grain for each 100 pounds of gain, and the pigs fed ground corn consumed 471 pounds of grain for each 100 pounds of gain.

Eleven trials out of eighteen showed a saving from grinding, the amount saved varying from 2.5 per cent. to 18.5 per cent. The remaining seven trials showed a loss from grinding, the loss varying from 1.1 per cent. to 11.1 per cent.

The average of the eighteen trials shows a saving of 6 per cent. from grinding corn.

Of the 140 pigs fed whole corn, 45 pigs gained more than the average, and 95 pigs gained less than the average. Of the 140 pigs fed ground corn, 91 pigs gained more than the average, and 49 pigs gained less than the average.

The authors of the bulletin point out that the economy of grinding corn will depend upon the price of corn and the cost of grinding, and the following table is given to assist the farmer in determining when to grind:

SAVING EFFECTED PER BUSHEL BY GRINDING CORN FOR FATTENING PIGS.

	Cents.	Cents.	Cents.	Cents.	Cents.	Cents.	Cents.	Cents.	Cents.	Cents.	Cents.
When corn is worth,	25	30	35	40	45	50	55	60	65	70	75
Saved by grinding,	1.5	1.8	2.1	2.4	2.7	3.0	3.3	3.6	3.9	4.2	4.5

The authors conclude that where there is plenty of time for maturing pigs, it is doubtful whether it pays to grind the corn. Pigs eat more corn when it is ground, and make somewhat more rapid gains. Ground corn is recommended for finishing hogs that have been fed shelled corn until near the close of the feeding period.

Other experiment stations, including Alabama, Maine, New York, Ohio, West Virginia, Kentucky, and Missouri have conducted tests in connection with this problem. Out of eleven trials at these stations, where the total food consumed is reported, four trials resulted in favor of the whole corn, and seven in favor of ground corn. In one trial where whole corn gave better results, the corn was soaked.

It will be seen, therefore, that the experience of other experiment stations is similar to that of Wisconsin. Results have not been uniform, but the larger number of trials, and the average results are in favor of ground corn, though the difference is not so marked as might be expected.

FEEDING SUPPLEMENTARY FOODS WITH CORN.

It has been already noted that corn is essentially a fat forming food, and that it is not a good bone and muscle former. The evil effects of exclusive corn feeding are most conspicuous in the case of young growing pigs, and numerous experiments have been conducted in feeding foods with corn which would tend to overcome its objectionable features. The influence of exclusive corn feeding upon the composition of the body has been discussed, but its influence upon the growth and economical gains of the animal has yet to be considered.

Blood Meal and Pea Meal.—In "Feeds and Feeding," Henry of the Wisconsin Experiment Station reports gains and food consumed by three lots of pigs fed as follows:

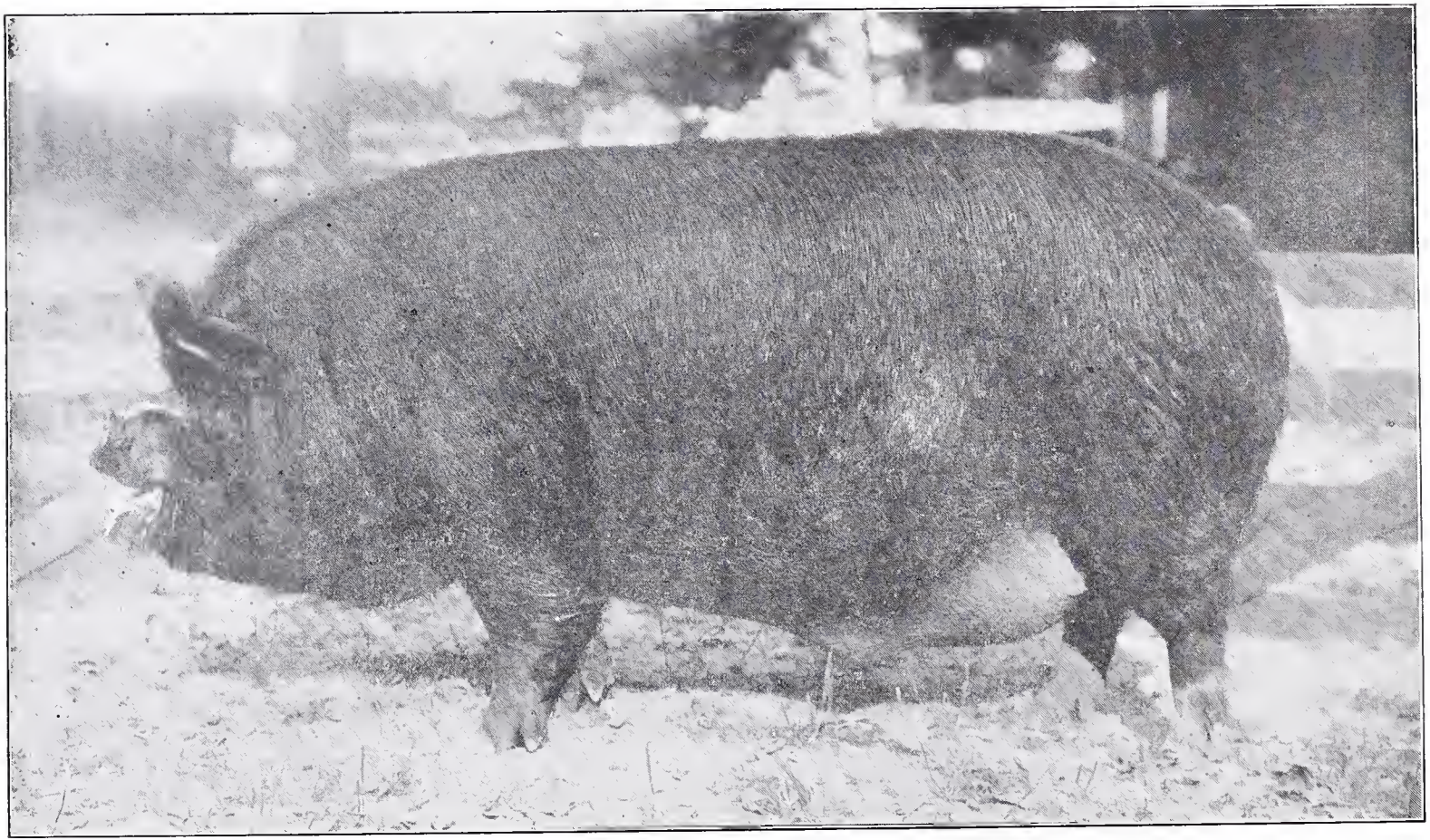
Lot 1. 1-3 blood meal, 2-3 corn meal.

Lot II. ½ pea meal, ½ corn meal.

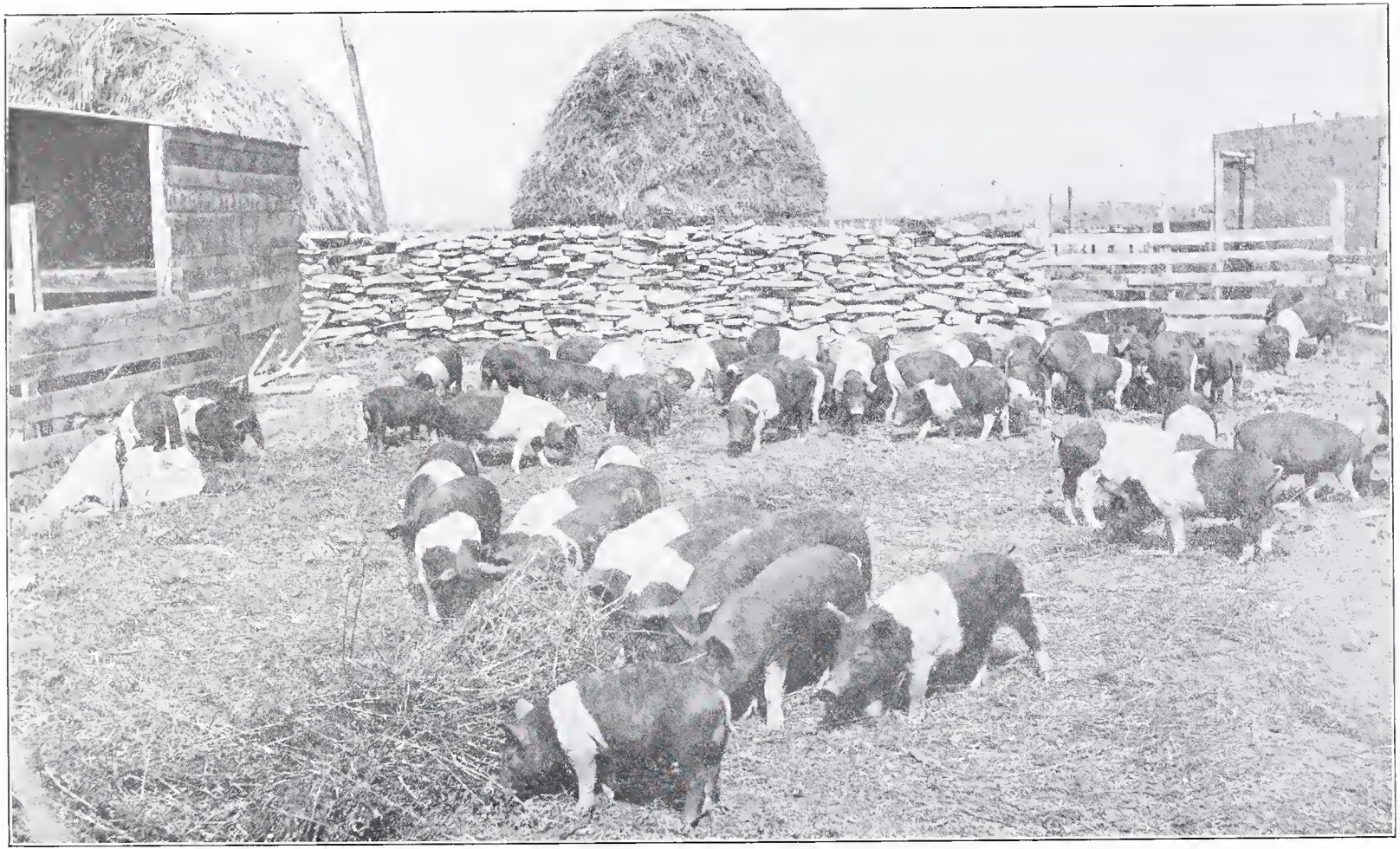
Lot III. Corn meal only.

During the trial,

Lot I gained 202 pounds, and required 409 pounds of feed for 100 pounds of gain.



BERKSHIRE—"LONGFELLOW'S DOUBLE RIVAL."
Sold by Hood Farm, Lowell, Mass., to Samuel P. Colt, Bristol, R. I., Price $3500.00.
Courtesy "The Country Gentleman."



HAMPSHIRES—FORAGING ON CLOVER HAY.
Courtesy "The Country Gentleman."

Lot II gained 180 pounds and required 449 pounds of feed for 100 pounds gain.

Lot III gained 155 pounds and required 481 pounds of feed for 100 pounds of gain.

Blood meal is very rich in protein, and peas are much richer in protein than corn. The effect of using such foods with corn is very noticeable in the larger gains and smaller food requirements for 100 pounds gain.

Bone Meal and Hard-Wood Ashes.—Henry also reports three trials in feeding bone meal with corn, and hard-wood ashes with corn, against corn alone, six pigs from the same litter being used in each trial. Regarding these trials, the author writes:

"As the trials progressed, it became evident that none of the pigs were properly nurtured, though the difference in favor of those getting bone meal or ashes was very marked. The pigs allowed neither ashes nor bone meal were most plainly dwarfed. * * * These dwarfs became so fat that the jowls and bellies of some of them nearly touched the ground."

The following table, taken from "Feeds and Feeding" shows some striking differences:

	When bone meal was fed.	When ashes were fed.	When neither was fed.
Corn meal required to produce 100 pounds of gain (pounds),	487	491	629
Average breaking strength of thigh bones (pounds),	680	581	301
Average ash in thigh bones (grams),	166	150	107

It will be seen from the above table that the appetite of the hog for such substances as ashes is not without significance.

Wheat Middlings and Skim Milk.—J. G. Fuller, of the Wisconsin Experiment Station, reports an experiment with two lots of Berkshire pigs. They were young pigs, weighing about 51 pounds each when the experiment began. One lot was fed corn meal only, and the other was fed a mixture of corn meal, wheat middlings, and skim milk. The following conclusions are drawn from the experiment:

If the pigs were valued at the same price per pound, the mixed ration lot would return a profit practically four times that of the corn lot.

The amount of dry matter required for a pound of gain was twice as great in the corn group as in the mixed ration group.

The mixed ration group made 4 1-5 times as great a gain as the pigs in the corn group.

On an average, the thigh bones of the mixed ration group were 50 per cent. stronger than those from the corn group.

The constitution of the pigs in the corn group was seriously impaired.

Finally, it is highly impracticable to raise growing pigs upon a ration of corn alone.

Soy Beans and Wheat Middlings.—Humphrey and Fuller, of the Wisconsin Experiment Station, report three tests in which soy bean meal was compared with wheat middlings as a supplement to corn. The soy bean is very rich in protein and fat, and the object of the experiments was to compare it with wheat middlings, which are generally recognized as being a good supplement to corn.

Two pounds of corn meal were fed with each pound of soy bean meal or middlings, and skim milk was also fed to both lots. Part of the time the hogs were on pasture, and part of the time in pens. The authors draw the following conclusions:

"Soy bean meal makes an excellent supplement to corn meal for growing and fattening pigs."

"Soy bean meal is from 8 to 10 per cent. more valuable than wheat middlings for economical pork production when the cost of the two feeds is the same."

"For firmness, fine grain, and texture of flesh, and even distribution of fat and lean, the ration of wheat middlings and corn meal is superior to that of soy beans and corn meal."

Looking over these conclusions, we must admit that soy beans have not made a very good showing, because, in most localities, wheat middlings would be very much cheaper. The influence upon the texture and firmness of the meat is also worthy of consideration.

Barley, Shorts, Meat Meal, and Tankage.—The Iowa Experiment Station reports an experiment with forty-eight well grown hogs divided into four lots. The rations of the different lots were as follows:

Lot 1. Corn, two parts; barley, one part; shorts, one part.
Lot 2. Corn.
Lot 3. Corn, nine parts; Armour's meat meal, one part.
Lot 4. Corn, nine parts; Swift's tankage, one part.

Meat meal and tankage are by-products of the packing house, and are both rich in protein. The meat meal used in this experiment contained 66.36 per cent. of protein, and the tankage 53.54 per cent. Such highly concentrated foods must be used in small quantities.

The hogs averaged 218 pounds each at the commencement of the trial which lasted thirty-two days.

The average daily gain per hog in each group was as follows: Meat meal, 2.6 lbs.; tankage, 2.3 lbs.; barley and shorts, 2.2 lbs.; corn alone, 1.8 lbs.

The food consumed per 100 pounds gain is shown in the following table:

	Corn.	Barley.	Shorts.	Meat meal.	Tankage.	Total.
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Lot 1. Corn, barley and shorts,	198.9	99.5	99.5			397.9
Lot 2. Corn alone,	463.5					463.5
Lot 3. Corn and meat meal,	333.3			37.0		370.3
Lot 4. Corn and tankage,	358.8				39.9	398.7

Foods were valued as follows:

Corn, 43c per 56 lbs., or 76.8c per cwt.
Barley, 35c per bushel, or 72.9c per cwt.
Shorts, $18.00 per ton, or 90c per cwt.
Meat meal, $35.00 per ton, or $1.75 per cwt.
Tankage, $33.00 per ton, or $1.65 per cwt.

According to these values, the cost of 100 pounds gain was as follows: Lot 1, $3.15; Lot 2, $3.56; Lot 3, $3.21; Lot 4, $3.41.

It will be noted that the group fed corn alone made the smallest daily gains, and the most expensive gains.

The cheapest gains were made by the lot fed corn, barley, and shorts, though this lot stood third in rate of gain.

The largest gains were made by the meat meal group, but the high price of the meat meal runs up the cost out of proportion to the rate of gain.

In this experiment, meat meal proved superior to tankage as a supplementary food with corn.

Meat Meal.—A second experiment by the Iowa Experiment Station was conducted with different proportions of Armour's meat meal with corn as compared with corn alone. Thirty-six pigs, averaging 137 pounds in weight, were divided into four groups and fed 100 days.

Lot 1. Corn meal 7 parts, meat meal 1 part.
Lot 3. Corn meal 8½ parts, meat meal 1 part.
Lot 4. Corn meal alone.

The average daily gain per pig, and the food consumed per 100 pounds gain, and the cost of 100 pounds gain, were as follows:

	Average daily gain.	Food Per 100 Pounds Gain.			Cost of 100 pounds gain.
		Corn.	Meat meal.	Total.	
	Lbs.	Lbs.	Lbs.	Lbs.	
Lot 1. Corn 7, meat meal 1,	1.74	381.6	54.5	436.1	$3 73
Lot 2. Corn 8½, meat meal 1,	1.78	409.2	47.9	457.1	3 81
Lot 3. Corn 10, meat meal 1,	1.85	409.9	40.9	450.8	3 68
Lot 4. Corn alone,	1.16	556.6		556.6	3 97

In computing the cost, corn meal was valued at 71.4c per cwt., and Armour's meat meal at $37.00 per ton.

It will be noted that the lot receiving 10 parts corn to 1 part meat meal made the most rapid, and the cheapest gains.

As in the first experiment, the hogs fed corn alone made the slowest and most expensive gains.

The report of the experiment states: "The pigs in all lots were uniformly very fat, and the difference in gain between the lots getting meal and the one getting corn alone seems to have been mostly in growth, although the meat meal pigs showed smoother, glossier hair."

Meat Meal, Tankage and Shorts.—A third experiment of the Iowa Experiment Station had for its object the comparison of Armour's meat meal and Swift's digester tankage with shorts, as supplements to a corn ration with young growing pigs. As the pigs were young, averaging 60 pounds in weight, it was not thought advisable to feed any of them corn alone in dry lots. The lots that were fed corn as the only concentrate were pastured on timothy or clover pasture. Altogether, 100 pigs were used, and divided into ten groups of ten pigs each.

Tankage and meat meal were fed in the proportion of one part tankage or meat meal to five parts corn meal.

Shorts were fed in two proportions, namely, one of shorts to two of corn meal, and one of shorts to one of corn meal.

The experiment lasted 112 days.

There are many interesting details of this experiment which can not be given here, and only the leading points will be referred to.

1. Meat meal and tankage proved practically equal as supplements to corn in point of producing gains, as will be seen from the following statement:

Ration.	Gain per hog.
Corn and meat meal on pasture,	164.9 lbs.
Corn and tankage on pasture,	162.9 lbs.
Corn and meat meal in dry lot,	128.8 lbs.
Corn and tankage in dry lot,	128.8 lbs.

2. The number of bushels of corn replaced by one ton of supplementary feed was as follows:

Ration.

Corn 2, Shorts 1, one on shorts replaced 46.6 bushels corn.

Corn 1, Shorts 1, one ton shorts replaced 45.3 bushels corn.

Corn 5, Meat meal 1, one ton meat meal replaced 57.9 bushels corn.

Corn 5, Tankage 1, one ton tankage replaced 64.4 bushels corn.

From this standpoint, tankage proved most effective.

3. When the hogs were upon pasture, shorts compared favorably with meat meal. The average total concentrates required for 100 pounds gain in the case of hogs fed corn and shorts on pasture was 403.9 pounds; in the case of the hogs fed meat meal and corn it was 409.6 pounds; for the hogs fed tankage and corn, it was 398.4 pounds.

4. In the dry lots, the highly nitrogenous foods, meat meal and tankage, showed to best advantage as compared with shorts, the average total food requirements for 100 pounds gain being 494.7 pounds for the shorts and corn lots; 409.9 pounds for the meat meal and corn lot; and 460.4 pounds for the tankage and corn lot.

5. Among the conclusions drawn from the experiment, the following statements occur:

"Meat meal and tankage of similar chemical composition are almost equal, pound for pound, as a supplement to a corn ration for growing pigs and fattening hogs."

"Hogs fed on rations composed of corn and meat meal, and corn and tankage, were fully as acceptable to the buyers, both from the standpoint of the quality and condition of the flesh, as those fed on any other rations used."

"Both meat meal and tankage are more valuable adjuncts to the corn ration for dry lot feeding than when pigs or hogs are being developed and fattened on pasture, especially if the pasture be composed of leguminous crops."

"A ration of one-half corn and one-half shorts produced greater gains with less feed per 100 pounds of gain, both on pasture and dry lot feeding, than a ration of two-thirds corn and one-third shorts."

SHORTS, SKIM MILK, TANKAGE, GROUND BONE, ALFALFA, PASTURE.

The Nebraska Experiment Station conducted a series of experiments with shorts, skim milk, Swift's digester tankage, and steamed ground bone.

Following are the rations used:

Corn meal alone.

Corn meal 75 per cent., shorts 25 per cent.

Corn meal 25 per cent., skim milk 75 per cent.

Corn meal 90 per cent., tankage 10 per cent.

Corn meal 95 per cent., tankage 5 per cent.

Corn meal 90 per cent., steamed ground bone 10 per cent.

During part of the time, the hogs were on alfalfa pasture, so that it is possible to study the effect of alfalfa with corn. The last experiment brings out the comparison very clearly, as is shown in the following table:

	On Alfalfa Pasture.		In Dry Lot.	
	Food for 100 lbs. gain.	Cost.	Food for 100 lbs. gain.	Cost.
Corn meal alone,	343	$2 38	543	$3 88
Corn 75%, shorts 25%,	336	2 64	533	4 18
Corn 25%, skim milk 75%,	*249 †704	3 19	*385 †1,063	4 87
Corn 90%, tankage 10%,	322	2 72	487	4 10
Corn 90%, ground bone, 10%,	336	2 62	533	4 17

*Corn.
†Skim milk.

In computing the cost, corn was valued at 40c per bushel, shorts at $20.00 per ton, skim milk at 20c per hundred pounds, tankage at $40.00 per ton, and ground bone at $30.00 per ton.

It will be noted that while the hogs were upon alfalfa pasture, the amount of corn required for 100 pounds of grain with the lot fed corn meal alone, compares very favorably with the other groups. But when the hogs were put into dry lots, the food for 100 pounds gain in the corn group is much higher than in the tankage group. The same is true of the corn and shorts group as comparerd with the corn and tankage group, so that here we find the same result as was found in the Iowa experiments.

If the same values for foods were used in the Nebraska experiments as were used in the Iowa experiments, the supplementary foods would make a better showing.

It must also be remembered that in Nebraska the hogs were kept upon alfalfa pasture until they were well grown, and, in consequence, were in the best possible shape to stand exclusive corn feeding on the dry lots.

Following are some points taken from Prof. Burnett's conclusions in connection with the investigation:

When pigs were in a dry lot, the use of tankage as about 5 per cent. of the ration generally reduced the cost of the pork produced.

All these experiments tend to show the suitability of corn and alfalfa as a ration for hogs.

The lot receiving corn and steamed ground bone show gains at practically the same cost as the lot receiving 5 per cent. tankage. The lot receiving ground bone required more food for 100 pounds gain, but the ground bone cost less per ton.

Skim milk at 20c per 100 pounds proved the most expensive supplementary food used.

Where supplementary foods were used, the hogs generally made more rapid gains and reached heavier weights in a given length of time, and cost less per pound gain than corn alone.

In a test of the breaking strength of the bones of the hogs in the Nebraska experiments, it was found that they stood in the following order in point of strength of bone: Corn and ground bone, corn and tankage, corn and skim milk, corn and shorts, corn alone.

Tankage vs. Linseed Meal.—The Indiana Experiment Station reports four tests in which Swift's digester tankage was fed in comparison with linseed meal as a supplement to corn.

The proportion of tankage to corn meal was 1 to 10 in the first experiment, 1 to 32 in the second, 1 to 20 in the third, and 1 to 15 in the fourth.

In each experiment the proportion of linseed meal to corn meal was twice as great as the proportion of tankage to corn meal, the linseed meal being poorer in protein than the tankage.

Corn was valued at $18.00 per ton, tankage at $40.00 per ton, and old process linseed meal at $30.00 per ton.

In two experiments, linseed meal proved slightly more economical than tankage, and in the other two, tankage had a fairly marked advantage.

The average of the four experiments show the food requirements and cost of 100 pounds of gain to be as follows:

Corn meal and tankage: 370 lbs. corn, 24.5 lbs. tankage, costing $3.82.

Corn meal and linseed meal: 363.6 lbs. corn, 46.2 lbs. linseed meal, costing $3.96.

It is noted in the summary that hogs fed on a ration of corn meal and tankage consume more feed and made more rapid gains than hogs fed a ration of corn meal and linseed meal.

Also, that a ration of corn meal and tankage gives a better finish than one of corn meal and linseed meal.

Soy Bean Meal vs. Linseed Meal.—Indiana also reports two experiments comparing soy bean meal with linseed meal as supplements to corn.

In the first experiment, 5 parts of corn meal were fed with 1 part of linseed meal or soy bean meal. In the second experiment, 8 parts of corn meal were fed with 1 part of linseed meal, and 7 parts of corn meal with 1 part of soy bean meal.

Linseed meal and soy bean meal were both valued at $30.00 per ton, and corn meal at $18.00 per ton.

On an average of the results of the two trials, it required for 100 pounds of gain:

Corn meal and linseed meal, 378 lbs. costing $3.71.

Corn meal and soy bean meal, 360 lbs. costing $3.55.

The percentage of protein in linseed meal and soy bean meal is very similar, and though soy bean meal showed an advantage over linseed in these experiments, the difference is not very marked.

Linseed Meal.—Professor Forbes of the Missouri Experiment Station reports results of an experiment in which 100 pounds of a mixture of 5 parts corn to one part linseed meal, proved equal to nearly 148 pounds of corn alone.

Tankage.—Indiana was the first experiment station to test tankage as a supplement to corn. In this trial, foods were valued as follows: Corn meal, $20,00 per ton; shorts, $16.00 per ton; tankage, $30.00 per ton. This method of valuing foods is very much more in favor of tankage as compared with corn, than the system followed in Nebraska.

The cost of 100 pounds of gain under this valuation of foods was as follows:

Lot 1. 10 parts corn meal, 1 part tankage, ...	$3.80
Lot II. 5 parts corn meal, 1 part tankage, ...	4.00
Lot III. Corn meal only, ...	5.20
Lot IV. 10 parts mix. of corn and middlings, 1 part tankage,	3.60

There were four pigs in each lot, and lot I gained 4.63 pounds per day, lot II, 4.91 pounds, lot III, 2.68 pounds, and lot IV, 4.55 pounds, a striking illustration of the effect of tankage upon the rate of gain.

Mineral Mixture.—Lack of sufficient mineral matter in swine rations is commonly experienced. The rapid growth swine are expected to make, require that an abundance of bone forming material be available at all times.

The following mixture has given satisfactory results, fed either in self-feeder or in troughs protected by cross pieces to prevent wasting:

100 lbs. finely ground lime rock.
100 lbs. finely ground phosphate rock.
100 lbs. hard wood ashes.
50 lbs. charcoal.
25 lbs. fine salt.
25 lbs. flowers of sulphur.
15 lbs. sulphate of iron (copperas).

Summary.—Many other instances of the effect of supplementary foods with corn might be given if space permitted. Sufficient tests have been quoted to establish a few important points which may be enumerated as follows:

1. Corn alone falls far short of being an ideal ration for hogs. It is especially injurious to young pigs, resulting in lack of growth, weakness of bone, and expensive gains.

2. When wisely combined with a supplementary food relatively rich in protein, corn makes one of the best hog foods obtainable.

3. Pasture, either grass or clover, makes a good supplement to corn, clover and alfalfa being especially desirable.

4. Very high-priced protein foods, such as tankage and meat meal, must be used in small proportions, and give best relative returns when used in dry lot feeding.

5. When hogs are on pasture, a comparatively cheap food, such as wheat middlings, will supplement corn to better advantage than expensive foods like tankage and meat meal.

6. Where soy beans can be grown to advantage, they constitute a valuable food to use as a supplement to corn.

7. For best bone development some additional mineral matter should be applied.

HOGGING OFF CORN.

The Minnesota Experiment Station has issued a most interesting bulletin on this subject. Hogging off corn means, turning the hogs into a field of standing corn, and allowing them to pull down the stalks and consume the corn at will.

Two experiments were conducted in which hogs allowed the run of a corn field were compared with hogs fed in a dry lot on ear corn. In the first experiment no shelter was provided for either lot, but they were given straw for bedding. In the second experiment, the yard hogs were given shelter, but the field hogs were treated as before.

Shorts were fed to each lot as a supplement to the corn, at the rate of one pound of shorts per day per hundred pounds weight of the pigs.

In the first trial there were 26 field hogs and 13 yard hogs; and in the second trial, 32 field hogs and 8 yard hogs.

The first trial commenced October 11th and ended November 29th. The second trial commenced September 19th and ended November 9th.

In each trial, the field hogs were given an acre of corn at a time, instead of being allowed the run of the whole field.

The ear corn consumed by the field hogs had to be estimated by taking samples.

The average daily gain per hog in the two trials was as follows:

1st trial: Field lot 1.3 lb. Ear corn lot, .98 lb.

2nd trial: Field lot, 1.44 lb. Ear corn lot, 1.09 lb.

The amount of feed consumed per 100 pounds of gain was as follows:

		Food Consumed per 100 Pounds Gain.		
		Shorts.	Ear Corn.	Total.
		Lbs.	Lbs.	Lbs.
First trial,	Field lot,	139	696	835
	Yard lot,	169	831	1,000
Second trial,	Field lot,	103	532	635
	Yard lot,	146	573	719
Average of two trials,	Field lot,	121	614	735
	Yard lot,	157	702	859

The larger amount of feed for 100 pounds gain in the first trial as compared with the second trial, is due to the fact that the weight of the ear corn when first husked was used in the first year's calculations, whereas the second trial is calculated upon a shrunk corn basis, that is, corn dry enough for market.

It will be seen that the field hogs made larger and more economical gains than the yard hogs in each experiment.

In the second experiment, a third group of hogs was used. These hogs were fed in a dry lot upon snapped corn, that is, the ears of corn without the husks removed. This lot occupied an intermediate position, both in rate and economy of gain, the snapped corn giving better results than the ear corn.

The following notes are taken from a summary appearing in Bulletin 104:

"The cost of fencing corn fields may be from $1.00 to $2.50 less per acre than the husking."

"It requires no more labor to prepare for subsequent crops, fields that have been hogged off than those that have been treated by the ordinary methods of harvesting."

"Hogs waste no more corn in field than when fed in yard. They pick the corn as clean as most men do in husking."

"Three pounds of rape seed (per acre) sown in corn at last cultivation, furnishes considerable succulent feed, which may take the place of high-priced shorts."

"It is not expected that all corn raised be fed off with hogs, but the amount they can clean up from the time it is nicely glazed until the weather becomes unfavorable, may be economically fed in this way."

"Hogs should not, as a rule, be turned into more corn at one time than they can eat up clean in two or three weeks. The shorter period is preferable."

It is recommended that varieties of corn be grown that will mature sufficiently by the first of September, so as to prolong the feeding period.

Pigs weighing from 100 to 140 pounds are best for the purpose. Small pigs are not suitable.

The table which follows is designed to show, approximately, the number of days required to hog off an acre of corn by a given number of pigs weighing 125 pounds.

	With Corn Shrunk to January 1, and Yielding.								
	30 bu. per acre.	35 bu. per acre.	40 bu. per acre.	45 bu. per acre.	50 bu. per acre.	55 bu. per acre.	60 bu. per acre.	65 bu. per acre.	70 bu. per acre.
	Days.	Days.	Days.	Days.	Days.	Days.	Days.	Days.	Days.
Will keep 10 hogs,	22.5	26.2	30	33	37.5	41.2	45.0	48.0	52.5
Will Keep 20 hogs,	11.2	13.1	15	16	18.7	20.6	22.5	24.3	26.2

From this table a farmer can readily reckon about how long a given field of corn will last any number of hogs.

This system calls for the use of portable fences.

The bulletin contains favorable reports from a number of farmers in different states who practice hogging off corn.

HOGS FOLLOWING STEERS.

Many farmers who fatten steers regard the hog as a necessary adjunct to the business if a profit is to be obtained. The hogs work over the droppings of the steers and fatten upon the undigested grain voided by the cattle.

The number of hogs per steer, which can be used to advantage, will vary with the character of the ration fed the steers. H. W. Mumford, in Bulletin 103 of the Illinois Experiment Station, states: "Where enough pigs are provided to consume undigested feed in the droppings of steers, it requires fully twice as many where corn is fed whole as it does where meal is fed to the steers." The same writer secured gains on hogs following steers ranging from 111.5 pounds of pork to 6.3 pounds of pork per steer, in a feeding period of six months. The largest gain was made by hogs following steers fed shelled corn, and the smallest by hogs following steers fed corn meal and silage.

Circular No. 12 of the Indiana Experiment Station gives a summary of nine hundred and twenty-nine replies to questions bearing upon beef production sent out by the Experiment Station. Eighty-eight per cent. of those sending replies reported that it was not profitable to feed cattle unless hogs follow. The average number of hogs per steer was 1.5, which is regarded as high by the authors of the Circular, unless additional feed is supplied the hogs. Indiana experiments indicate that the waste will not support more than one hog to a steer. The average age of hogs preferred by cattle feeders for following steers was about 5 months, and the average weight 92 pounds, denoting that comparatively thin, active hogs following cattle was reported as 1.4 pounds per hog per day.

Bulletin No. 76 of the Missouri Experiment Station is similar to the Indiana Circular, and embraces the experience of nearly a thousand cattle feeders in Missouri, Iowa and Illinois. Director Waters summarizes the replies to the questions of the number of hogs per steer, as follows: "An approximate average number of hogs per steer would be like the following, on the basis of two-year-old cattle and 100 or 150-pound hogs: Snapped ear corn, 2 to 3 hogs per steer; ear corn, 1½ hogs per steer; shelled corn, 1 to 1½ hogs per steer; crushed or ground corn, 1-3 to ½ hog per steer."

The more liberally the cattle are fed, the more hogs can be maintained upon their droppings, and it is quite likely that the greater care exercised by experiment stations in feeding steers to prevent waste, accounts for the greater number of hogs maintained per steer in ordinary feed lots, than in the feed lots of experiment stations.

When hogs are following corn-fed steers, supplementary foods rich in protein are found beneficial, just as they are beneficial when corn is fed directly to the hog. Waters points out that: "Hogs make better gains when following cattle fed corn and clover, or cowpea, or alfalfa hay, than when following cattle fed corn and timothy, millet, sorghum, or straw for roughness." He also states that hogs following cattle fed linseed meal or cottonseed meal along with their corn ration, make better gains than those following cattle fed corn alone, the linseed meal proving especially beneficial. In twelve years' experience, he has found no evil effects upon hogs following cattle whose meal ration contained one-sixth to one-quarter cottonseed meal.

In summer feeding, access to a pasture will take the place of other supplemental foods, clover and alfalfa being especially effective.

VARIOUS GRAINS, MEALS, AND BY-PRODUCTS.

Peas or Canada Field Peas.—This grain is comparatively little known in the United States, and is used to a smaller extent for pig feeding in Canada than it was some years ago, mainly owing to the high price it commands for other purposes.

At the Utah Experiment Station, hogs fed ground peas and bran, equal parts, made an average daily gain of 1.09 pound and required 363 pounds of meal for 100 pounds of gain; while hogs fed corn and bran made an average daily gain of .63 pound and required 455 pounds of meal for 100 pounds of gain.

At the South Dakota Station, the daily gain of pigs fed whole soaked peas was 1.21 pound, and for soaked corn meal 1.40 pound, but the grain required for 100 pounds gain was 421 pounds for the peas group and 458 pounds for the corn lot.

The Ontario Agricultural College found that feeding pea meal alone was injurious to pigs, the heavy, close nature of the meal making it indigestible. This peculiarity of pea meal is generally recognized. Pea meal alone was less satisfactory than corn meal alone, but when mixed with one-third of its weight of wheat middlings, it gave much better results than corn meal.

The pea meal is very rich in protein and should make a good supplementary food to corn.

Barley.—Barley is richer in bone and muscle forming constituents than corn, having a higher percentage of ash and protein. In fattening constituents, it is scarcely equal to corn.

The Wisconsin Experiment Station reports two feeding trials with barley and corn. In the first trial, the grains were fed alone, and in the second they were fed with skim milk.

The first of the trials shows that it required 471 pounds of barley to produce 100 pounds of gain, and 435 pounds of corn to produce 100 pounds of gain.

In the second trial it required 330 pounds of barley and 398 pounds of skim milk for 100 pounds gain, and 306 pounds of corn and 371 pounds of milk for 100 pounds gain. In each trial, therefore, it required more barley than corn for 100 pounds gain.

Colorado and Ontario experiments found in favor of barley as compared with corn.

The first Wisconsin trial gave the most marked results in favor of corn, and it is worthy of note that the hogs in this trial averaged over 200 pounds in weight at the commencement of the trial. Where younger hogs were used, barley made a better showing as compared with corn. There is little doubt that, considered as a fat former, corn is superior to barley, and hence well grown pigs would be able to stand exclusive corn feeding much better than younger pigs. The writer's experience would lead him to prefer barley to corn as a meal ration for growing pigs, and this view is borne out by the experiments noted. One disadvantage of barley is the fact that it is not eaten so readily by pigs as one might wish, and should be mixed with some other food to increase its palatability. Barley is well adapted to mixing with corn as a ration for almost any class of pigs. The extensive use made of barley for swine feeding in Canada, Great Britain, Denmark and other countries, is strong evidence of its value.

Wheat.—Wheat has been experimented with, more or less, as a food for swine, and results show that there is comparatively little difference between wheat and corn in feeding value. Wheat contains less fibre than barley, but ground wheat alone can hardly be regarded as a satisfactory ration, owing to the fact that it is likely to cause digestive troubles. It gives much better results when mixed with other meal, and combines well with corn. As a general thing, feeding sound wheat is out of the question, owing to its relatively high price. It is only under exceptional circumstances that it can be counted among foods for swine.

The Wyoming Station secured better gains for food consumed from wheat than from corn in each of two experiments, reported in Bulletin 74.

Frosted Wheat.—In some years, considerable of this product is placed upon the market. Wheat may be sufficiently injured by frost to render it unfit for milling, and yet be practically equal to sound

wheat for feeding purposes. Frozen wheat varies much in character, depending upon the degree of maturity reached by the grain before being frozen.

In his evidence before the Committee on Agriculture, J. H. Grisdale, of the Central Experimental Farm, Canada, gives details of swine feeding experiments with frozen wheat, fed alone and in combinations. The following table brings out the principal points:

Character of Ration.	Average weight of pigs at commencement.	Average daily gain.	Pounds meal per 100 pounds gain.
	Lbs.	Lbs.	Lbs.
Lot 1. No. 1 frozen wheat 2 parts, shorts 1 part,	99.1	.76	390
Lot 2. No. 1 frozen wheat 2 parts, corn 1 part,	76.0	.77	370
Lot 3. No. 2 frozen wheat 2 parts, corn 1 part,	118.2	1.03	390
Lot 4. No. 2 frozen wheat only,	140.0	1.23	360
Lot 5. No. 2 frozen wheat only,	85.0	.71	380
Lot 6. No. 2 frozen wheat 2 parts, barley 1 part,	104.1	.81	410
Lot 7. No. 1 frozen wheat 2 parts, oats 1 part,	112.1	1.02	390
Lot 8. No. 1 frozen wheat 2 parts, oats 1 part,	74.2	.66	390
Lot 9. No. 2 frozen wheat with 3 lbs. skim milk daily per pig,	99.0	.88	340
Lot 10. No. 1 frozen wheat only,	159.4	.94	410
Lot 11. No. 1 frozen wheat only,	96.3	.79	390
Lot 12. Equal parts No. 1 frozen wheat, No. 2 frozen wheat and corn,	124.8	.94	470

It is unsafe to make comparisons of the different rations, but the table fails to show any advantage of the No. 1, frozen wheat over the No. 2.

The most remarkable feature of the experiment is the uniformly good results obtained with all the groups, indicating frozen wheat to be a valuable food for swine.

At the Ontario Agricultural College, the writer fed three lots of pigs to compare frozen wheat with barley. The frozen wheat tested only 43½ pounds per bushel.

Lot 1 contained 18 pigs, and was fed ground barley and wheat middlings.

Lot 2 contained 20 pigs, and was fed ground frozen wheat and wheat middlings.

The proportion of middlings varied, being reduced as the experiment progressed, but was the same for all lots.

The pigs in Lot 1 averaged 41 pounds in weight at the start, Lot 2, 37.7 pounds, and Lot 3, 54.5 pounds.

Lot 1 made an average daily gain per pig of 1.08 lb., Lot 2, 1.1 lb., and Lot 3, 1.18 lb.

The amount of meal consumed per 100 pounds gain was as follows:

Lot 1, 430.9 lbs.
Lot 2, 431.4 lbs.
Lot 3, 432.9 lbs.

Both in rate of gain and food consumed per 100 pounds gain, the three rations may be said to have given practically the same results. In this experiment, therefore, frozen wheat proved equal to barley when fed with middlings.

Oats.—Owing to their high percentage of fibre, oats do not possess a high value for fattening hogs. When used at all, they should be used as only a comparatively small part of the ration, and they show to best advantage when used to lighten and give more bulk to a heavy, close-textured meal, such as pea meal, or even corn meal. They are especially useful for making up part of the ration for boars or breeding sows, where the aim is to maintain vigor without unduly fattening.

Rye.—Extensive Danish experiments summarized by Prof. Henry in "Feeds and Feeding" indicate that rye and barley are about equal in value for pig feeding. Very little experimental work with the grain of this cereal has been done in America. Rye meal is best fed in combination with other kinds of meal.

Kaffir Corn.—At the Kansas Experiment Station, it was found that corn meal had a feeding value of from 17 to 29 per cent. higher than Kaffir corn meal. The addition of soy bean meal to Kaffir corn to the extent of one-third of the ration materially improved its value, but did not make it equal to a similar mixture of corn meal and soy bean meal.

Buckwheat.—The Central Experimental Farm, Canada, reports two trials in which buckwheat was compared with wheat. In the first trial, ground buckwheat was fed against ground wheat, and in this trial 445 pounds of ground buckwheat were required for 100 pounds gain, and 410 pounds ground wheat for 100 pounds gain.

In the second trial, one lot of pigs was fed a mixture of one-half mixed meal, and the other lot a mixture of one-half ground wheat and one-half mixed meal. In this trial it required 405 pounds of the buckwheat mixture for 100 pounds of gain, and 380 pounds of the wheat mixture for 100 pounds of gain. This is a much better showing for buckwheat than might be expected, since buckwheat has a thick, fibrous hull which the hog cannot digest. Ground wheat showed an advantage of only about $8\frac{1}{2}$ per cent. over ground buckwheat, and the wheat mixture an advantage of $6\frac{1}{2}$ per cent. over the buckwheat mixture.

Emmer.—This grain is commonly known as "spelt" or "speltz." Genuine spelt is a distinct plant, possessing general characters similar to emmer, but is a smaller yielder and possesses about ten per cent. more hull than emmer.

The South Dakota Station reports one experiment with emmer, under the name of "speltz." One lot of hogs was fed whole emmer, one ground emmer, and one emmer and corn. Whole emmer required 771 pounds of feed for 100 pounds of gain; ground emmer 826 pounds, and emmer and corn, 529 pounds. It will be seen that a marked improvement was effected when corn was added to the emmer. Apparently emmer has too much hull or husk (about 21 per cent.) to make a first class hog food. Its rational use would be for mixing with concentrated, heavy meals to give more bulk to the ration.

Millet Seed.—The South Dakota Station (Bulletin 83), reports a comparison of millet seed with barley and wheat. The authors of the bulletin state that millet seed can be grown profitably as a fattening ration for swine, but it does not furnish as good a ration as barley or wheat. It is also stated that it required one-fifth more millet than it did barley meal, and a trifle more barley meal than it did wheat to make a pound of gain, and that a bushel of 56 pounds of millet seed is equal to a bushel of 48 pounds of barley for hog feed. Millet meal produced a softer quality of fat than did either barley or wheat meal.

Beans.—Beans are best thoroughly cooked before they are fed to swine. Bulletin 243 of the Michigan Experiment Station reports results from feeding cull beans to growing pigs and fattening pigs. Without going into details, it may be stated that an exclusive ration of beans is not regarded as satisfactory. For growing pigs, a ration consisting of three parts beans and four parts corn meal did not prove so satisfactory as a mixture of two parts beans, two parts wheat middlings, and three parts corn meal. The last named mixture gave an average daily gain per pig of about one and one-third pounds per day, which is regarded as satisfactory.

Three trials of beans compared with equal parts beans and corn meal were made with fattening hogs. The results of the three trials are briefly summarized in the following table:

	Fed beans alone.	Fed equal parts beans and corn.
	Lbs.	Lbs.
Average live weight of hogs,	163	159
Average daily gain per hog,	1.1	1.52
Average food consumed per 100 lbs. gain,	420.9	406.4

The addition of corn meal increased the efficiency of the ration about $3\frac{1}{2}$ per cent.

The relative cost of the two foods, and the cost of cooking, would have to be considered by the feeder in coming to a decision regarding the economy of the rations.

Wheat Middlings.—Wheat middlings, frequently called "shorts," is one of the very best food for young pigs. It is rich in bone and muscle-forming constituents, and does not tend to make growing pigs too fat. Its value as a supplement to corn has already been noted, and it combines well with almost any kind of meal. As a single food for fattening, it is not economical, but it is conducive to thrift and growth when used as a part of a meal ration for fattening pigs. The younger the pig, the greater the value derived from feeding middlings.

Wheat Bran.—Bran is too bulky and fibrous to constitute a large part of a pig's ration, unless it is mature animals, such as stock boars and breeding sows, or where it is desired to give bulk to a ration that is considered too heavy in character. As a rule, however, middlings can be used to better advantage than bran for the purposes mentioned.

Flour.—Various brands of low-grade flour are occasionally put upon the market. Low-grade flour has a higher feeding value than middlings, but is entirely unsuitable for feeding alone, owing to its pasty nature. The writer's experience is that it will cause digestive derangement when fed alone, and must be diluted to a large extent with other foods. Bulletin 167 of the Virginia Experiment Station reports better results from soaking low-grade flour, than from feeding it freshly mixed with water.

Corn and Cob Meal.—Whatever advantage corn and cob meal may have over corn meal for other classes of stock, it can scarcely be commended for hog feeding. It is difficult to grind the cob fine enough to make it acceptable to hogs, and as the cob has practically no nutritive value for hogs, it is difficult to see any good reason for including it in their ration, unless it is to act as a diluent for the corn meal, which is inclined to be close in texture and heavy in character. There are many other substances, however, that will answer this purpose and supply nutriment as well. The Missouri Experiment Station gives a decidedly adverse report upon feeding corn and cob meal to hogs, but Kansas and New Hampshire report in its favor. Experimental evidence regarding the problem is somewhat meagre.

Gluten Meal.—The Central Experimental Farm, Canada, reports unfavorably upon gluten meal as a food for swine. J. H. Grisdale says regarding it: "Gluten has been fed in limited quantities, but has not proven very satisfactory for either bacon production, young pigs, or breeding stock. It seems to be rather unpalatable, and produces soft bacon."

The Cornell Station also gives an unfavorable report of this food as compared with corn when both foods were fed with skim milk.

Linseed Meal (Oil Meal.)—Linseed meal has been already referred to under supplementary foods with corn. It is seldom advisable to feed linseed meal to a greater extent than one-fifth of the total meal ration, and as a rule, half this quantity will be found more economical. It is highly recommended by some as a food for nursing sows, and for young pigs after weaning. The writer has had only fair success in its use as a substitute for skim milk with young pigs.

In experiments with substitues for skim milk for young pigs, the Central Experimental Farm, Canada, obtained an average daily gain of six-tenths of a pound per pig with a mixture consisting of 4 parts wheat middlings and one part linseed meal. It required 280 pounds of the mixture for 100 pounds of gain, which is a very satisfactory showing. The linseed meal was not so satisfactory as skim milk, but gave better results than other substitutes for skim milk tested at the same time.

Cottonseed Meal.—This very concentrated food possesses some property which renders it fatal to hogs when used in considerable quantities. A small allowance per day may be fed without injurious results, but great care is necessary. The Arkansas and Texas Experiment Stations have probably made the most thorough investigations with cottonseed meal, and their recommendations are worthy of note.

Arkansas Bulletin No. 85 gives the following quantities of cottonseed meal per pig per day as being "well within the danger limit."

Pigs under 50 pounds, one-fourth pound per day .

Pigs from 50 to 75 pounds, one-third pound per day .

Pigs from 75 to 100 pounds, two-fifths pound per day.

Pigs from 100 to 150 pounds, one-half pound per day.

Texas Bulletin No. 78 makes the following recommendations:

"1. For animals on heavy feed, that not more than one-fourth the weight of the grain ration consist of cottonseed meal.

2. That this feeding continue not more than 50 days, or that the proportion of meal be reduced if feeding is to be continued longer.

3. That the meal be mixed with other food and all soured together.

4. That as much green food as possible be supplied to the hogs.

5. That a close watch be kept and the meal taken from any animals not eating or not gaining well.

Feeders who have had experience with the meal will probably be able to exceed these recommendations, which, however, allow the use of enough meal to greatly improve a corn diet. One pound of cottonseed meal to five of corn furnishes the nutrients in the most desirable proportions for fattening, while one to two of corn are more nearly correct for young, growing stock."

Hogs following cattle which are fed a considerable amount of cottonseed meal in their ration do not appear to be injuriously affected, though there seems to be exceptions to this rule. Just how much cottonseed meal can be fed to cattle without injury to the hogs following them, does not appear to be definitely settled. Prof. E. T. Robbins, of the Iowa Experiment Station, writing to the Breeder's Gazette, reviews the experience of cattle feeders in connection with this problem, and states: "Even when fed to steers under the best circumstances it may possibly, in the opinion of some feeders, be associated with an unaccountable mortality among the hogs." In summing up, he says: "The general consensus of opinion is to the effect that if fed in no larger amounts than 2 to 3 pounds daily per steer, with as many hogs as steers in the feed lot, all danger to the hogs is practically eliminated."

Oat Feed.—This by-product of the oat meal sometimes has a considerable feeding value, but, owing to the fact that it often contains a large proportion of oat hulls, it is not a very satisfactory food to buy for swine. Experiments with oat feed are not satisfactory, because the product is anything but constant in composition. The same remarks apply to all by-products of the oat meal mills, whatever name they may be sold under.

Brewers' and Distillers' Grains.—Grisdale, of the Central Experimental Farm, reports economical gains from "spirit grains" when fed in combination with a meal ration. Generally speaking, these products are rather bulky and fibrous for swine, unless used in limited quantity as a supplement to a grain ration, in much the same way as alfalfa hay or roots may be used.

Sugar Beet Pulp.—In the wet state, this product may be regarded as similar in feeding value to roots, and may be employed in exactly the same way. The dried pulp is hardly a satisfactory food for swine.

Beet Sugar Molasses.—Beet molasses is unpalatable and generally unsatifactory for swine. Bulletin 199 of the Cornell Experiment Station reports apparent poisoning of hogs fed beet molasses; and Utah (Bulletin 101) reports scouring, and bad flavored pork.

Cane Molasses.—Cane and sorghum molasses are sweet and palatable. Prof. Henry estimates cane molasses as equal to corn in feeding value. As a rule, these products are rather expensive for ordinary feeding, but they are sometimes used in fitting animals for show, as they are appetizing and tempt the animals to eat.

Rice By-Products.—Rice hulls are very woody, and are of very little use for any animals, but are especially objectionable for swine. Rice bran and rice polish have considerable feeding value, but since any food made up from rice by-products is apt to contain a considerable proportion of hull, feeders are inclined to look upon these foods with suspicion. The South Carolina Experiment Station compared rice meal and skim milk with corn meal and skim milk for pigs, and obtained results slightly in favor of rice meal. The rice meal is stated to consist largely of rice flour, rice polish, and rice bran. At the Massachusetts Experiment Station, rice meal and milk proved practically equal to corn meal and milk for pigs.

Weed Seeds.—Prof. Henry conducted two trials at the Wisconsin Experiment Station with pigeon-grass seed, cooked and uncooked, for swine. The results are reported in "Feeds and Feeding."

Lot 1 was fed two-thirds cooked pigeon-grass meal and one-third corn meal, uncooked.

Lot 2 was fed corn meal only, uncooked.

Lot 3 was fed one-third pigeon-grass meal and two-thirds corn meal, both uncooked.

Lot 1 made the largest gains and required the least food for 100 pounds of gain, and Lot 3 made the smallest gains and required the most food for 100 pounds of gain.

Prof. Henry says: "It is evident that pigeon-grass seed when cooked is a valuable feed for swine. * * * * * * * To be satisfactory for pig feeding the seed of this grass should be ground and cooked."

At the large elevators, weed seeds and small wheat accumulate in large quantities, and this product can be used to good advantage in feeding swine when judiciously mixed with other meal.

Utilization of Garbage as Feed.—Professor C. F. Minkler of the New Jersey Experimental Station writes as follows on the use of garbage in connection with swine feeding:

"It is clear that the solution of the problem of garbage disposal now confronting almost every large city in the State lies in the utilization of the collected materials for swine feeding. It will not be many years before the city authorities will appreciate the value to the community of a plant that will suitably prepare the collected refuse for swine feeding, and instead of being an item of expense as is now the case, it will prove a source of genuine revenue. It is scarcely feasible to feed raw garbage to pigs located within reasonable delivery districts from the city, and it is extravagant to install an incinerator. By educating the public to sort the garbage from the refuse, and establishing a systematic method of collection, enabling prompt delivery of this material to a plant where the product may be pasteurized and concentrated by means of huge digesters, the end product, properly neutralized and mixed with available by-products from mills or factories, will make an excellent feed for swine. The residue may be used to advantage by fertilizer concerns as a dryer or filler, or even as a source of plant-food. The feeding value of material now being wasted, buried, pumped into rivers, or dumped into the ocean would amount to millions of dollars. We have fed a garbage product identified as "Stick," and another product known as "Organic Meal," to pigs experimentally at the Experiment Station for the past three years, and have been able to produce gains by the use of these products at a cost of less than three cents a pound. I am convinced that an unusual opportunity is afforded in the development of such a project, and once established it will revolutionize the swine feeding industry of this country. No doubt the suggestion will seem to many an idle dream. The time is coming, however, when just such an industry will be established, and pork production conducted on an extensive factory basis.

FEEDING RAW GARBAGE.

Within certain districts of the State, notably in the vicinity of Secaucus, considerable raw garbage is fed to swine. In other instances it is degreased; that is, cooked for twenty-four hours in large steam digesters, after which the grease, rising to the top is skimmed off and sold for various uses, such as the manufacture of

soaps and low grade lubricants. Where the raw garbage is fed directly to the pigs it is desirable to construct either wooden or cement feeding platforms where the material can be sorted by the pigs themselves. At best this practice will be insanitary, and especially where the residue is not cleaned up daily and buried or plowed under. The best results have been secured with projects of this sort where some additional concentrated food was supplied to the pigs in addition to the raw garbage. At best the collected material varies from day to day, and especially from summer to winter conditions, a change which interferes more or less with the pig's appetite and ability to put on flesh. Stale bread is rather commonly fed in the Secaucus district, but it is clear that the feeding of a concentrated feed, such as corn, hominy meal, molasses or some mill by-product, would materially shorten the pig's growing period, and develop a carcass that would be firmly fleshed rather than watery and soft, as found where garbage is fed exclusively. Then, again, by supplying at least 40 per cent. of the pigs ration in concentrated form, substantially uniform in composition from day to day, there is little danger of indigestion and over-feeding such as is true where the pigs consume more garbage than is required one day, and the mixture is thinned or diluted with water the next day in order that it may go the rounds. The practice of feeding excessive amounts of diluted swill or slop is unsatisfactory. Anxious to satisfy its appetite, the pig devours excessive amounts of this washy material, which often brings distress, and even then does not satisfy the appetite. The animal really starves on a full stomach; a peculiar condition, no doubt, but a fact, nevertheless. Pigs require concentrated feeds and unless supplied with them the best results will not be obtained."

"Stock Foods."—In Bulletin 151 of the Wisconsin Experiment Station, Prof. F. W. Woll gives a review of the work of experiment stations with so-called "stock foods," or "condimental stock food." In summing up, Prof. Woll says, in part:

"The feeding experiments include twenty-three different trials, conducted at more than a dozen different experiment stations with 992 animals in all; viz., with 78 steers, 81 dairy cows, 604 sheep, 112 pigs, and 117 hens. * * * In going over the evidence presented we find that only two of the twenty-three different trials showed the stock food to possess any merit; the conclusions drawn from the results of the twenty-one trials is to the effect that nothing was gained by including these foods in the ration fed; in fact they were shown to be a positive detriment in so far that they rendered the rations more expensive and increased the cost of the product obtained, whether this be gain in live weight, milk, butterfat, wool, or eggs."

Among the conclusions drawn from investigation work with "stock foods" are the following:

"They are of no benefit to healthy animals when fed as directed, either as to increasing the digestibility of the feed eaten or rendering it more effective for the production of meat, milk, wool, etc."

"They are of no benefit as a cure-all for diseases of the various classes of livestock; neither do they possess any particular merit in case of specific diseases, or for animals out of condition, off feed, etc., since only a small portion of ingredients having medicinal value is found therein, the bulk of the foods consisting of a filler which possesses no medicinal properties whatever."

"Exhorbitant prices are charged for these foods."

"By adopting a liberal system of feeding farm animals and furnishing a variety of feeds, good results may be obtained without resorting to stock foods of any kind. If a farmer believes it is necessary to feed stock foods at times, he can purchase the ingredients at a drug store and make his own stock foods at a fraction of the cost charged for them by the manufacturers."

The following formulas for stock foods, suggested by two American experiment stations, are given in the bulletin:

1. Ground gentian, one pound; ground ginger, one-fourth pound; powdered saltpeter, one-fourth pound; powdered iron sulphate, one-fourth pound. Mix, and give one tablespoonful in feed once daily for ten days, omit for three days, and feed as above for ten days more. Estimated cost, 20 cents a pound. Estimated tonic value, about four times that of most condimental foods on the market.

2. Fenugreek, 8 pounds; ginger, 8 pounds; powdered gentian, 8 pounds; powdered sulphur, 8 pounds; potassium nitrate, 8 pounds; resin, 8 pounds; cayenne pepper, 4 pounds; flax-seed meal, 44 pounds; powdered charcoal, 20 pounds; common salt, 20 pounds; wheat bran, 100 pounds.

This mixture is said to be: "So near the average stock food that neither the farmer nor his stock could tell the difference." Estimated cost, less than $4.42 per hundred pounds.

3. Powdered gentian, 1 pound; powdered ginger, 1 pound; fenugreek, 5 pounds; common salt, 10 pounds; bran, 50 pounds; oil meal, 50 pounds. Estimated cost $1.50 per hundred pounds.

PASTURE AND SOILING CROPS.

Alfalfa.—Bulletin 155 of the Kansas Experiment Station gives a summary of results from feeding alfalfa to hogs at that institution. The following is quoted directly from the bulletin:

"At this station some years ago, a gain of 800 pounds of pork was made from a ton of alfalfa hay, and a little less than that amount of gain was made from an acre of alfalfa pasture. In another test here, an acre of alfalfa produced $20.20 worth of pork, while an acre of rape fed to a similar lot of hogs returned $10.05 worth of pork.

"In a later experiment we found that 100 pounds of alfalfa hay saved 96 pounds of corn. Figuring on the basis of 5 pounds of corn producing one pound of pork, the 96 pounds of alfalfa would produce 19 pounds of pork. Estimating the average yield of alfalfa to be four tons per acre, on this basis it would mean a production of 1,600 pounds of pork per acre, with alfalfa fed in the form of hay in connection with corn. This experiment was conducted during the winter season.

"In an experiment during the summer, we found that 170 pounds of green alfalfa, cut and fed to hogs fresh in a dry yard, was equal to 100 pounds of corn, and in this experiment it took 6 pounds of corn to produce a pound of pork. Therefore, assuming 170 pounds of green alfalfa would produce 16 2-3 pounds of pork, a fraction over 10 pounds of green alfalfa would produce one pound of pork. Estimating that an acre of alfalfa will yield during the season 20,000 pounds of green hay, this experiment would show that such an acre of alfalfa, cut green and fed fresh, would produce something like 2,000 pounds of pork. Of course, this is fed in connection with corn, and a statement that an acre of green alfalfa would produce 2,000 pounds of pork would be very misleading. Figuring on the basis of these two experiments, alfalfa hay, yielding four tons per acre (8,000 pounds) would produce 1,600 pounds of pork, and its value at 4 cents per pound would be something like $64.00 per acre; and green alfalfa producing ten tons per acre (20,000 pounds) would produce 2,000 pounds of pork, which, at 4 cents per pound, would be worth $80.00 per acre."

The Kansas results from feeding alfalfa are about the most favorable of which the writer is aware. Very fair results were obtained at the Wyoming Experiment Station, where alfalfa hay and wheat were fed against wheat alone. In this experiment it required 449 pounds of wheat for 100 pounds of gain where wheat was fed alone; and 319.3 pounds of wheat and 291.3 pounds of alfalfa for 100 pounds of gain where wheat and alfalfa hay were fed. On this basis, a ton of alfalfa hay would give scarcely 200 pounds of pork, which is only one-quarter as much pork as was obtained at Kansas from a ton of alfalfa hay. It is well to remember, however, that alfalfa hay varies very much in quality. Well cured, fine-stemmed, leafy hay would be best for hog feeding, and coarse-stemmed hay that has been damaged more or less by the weather, might have very little value for this purpose. Such a discrepancy as that noted between the Kansas and Wyoming results might easily be accounted for on the basis of different qualities of hay, and in the meantime, we may regard the Kansas results as representing the maximum returns from alfalfa. It is also worthy of note that in one Kansas experiment the amount of pork produced by a ton of alfalfa hay was only 235 pounds, an amount only slightly greater than that obtained at Wyoming, so that it would be safer to regard the 800 pounds of pork from a ton of alfalfa hay as a possibility, rather than as something which can be generally depended upon.

The Wyoming Station also tried feeding young pigs, weighing from 60 to 70 pounds, a ration of one-third corn meal or wheat meal, and two-third alfalfa hay, but the pigs lost weight, and one died. On the other hand, mature sows were successfully maintained on a ration of alfalfa hay and turnips without other food, indicating that alfalfa hay is best suited to pigs that are fairly well grown.

Rape.—Rape is a crop which is highly recommended wherever it can be grown successfully. For hog pasture it is best sown in drills abount 28 inches apart at the rate of three pounds of seed per acre. It may also be sown broadcast. In most localities, it is safer not to sow until after the first of June. If there is enough moisture in the soil to germinate the seed, it is generally ready for pasture in about six weeks.

The Kansas Experiment Station compared rape with alfalfa for pigs averaging 52 pounds at the commencement of the experiment. Ten pigs were used in each lot. Following are daily gains per head and pounds of grain consumed per 100 pounds of gain:

	Daily Gain.	Grain Consumed per 100 Pounds Gain.
Lot 1. No pasture, ...	1.04 lbs.	371 lbs.
Lot 2. Rape pasture, ...	1.09 lbs.	301 lbs.
Lot 3. Alfalfa pasture, ...	1.10 lbs.	200 lbs.

An acre of rape was required for ten pigs, but half an acre of alfalfa was sufficient for the same number.

An acre of rape pasture produced 202 pounds of pork, and an acre of alfalfa pasture produced 408 pounds of pork.

"This experiment emphasizes the superior value of alfalfa, and likewise emphasizes the value of Dwarf Essex rape, which can be seeded in the feed-lots that would otherwise go to waste or grow up to weeds, and be made to pay a handsome profit on the investment."

At the Wisconsin Experiment Station, Craig conducted two experiments with hogs on rape. In the first experiment, 10 hogs, about eight months old, were pastured on one-third of an acre of rape for 76 days, and fed corn and shorts in addition.

Another lot was fed in a pen on corn and shorts only. In the second experiment, 19 hogs were pastured seven weeks on six-tenths of an acre of rape, as compared with a similar lot in pens on grain only.

In the first trial one-third of an acre of rape was equivalent to 1062 pounds of grain and in the second trial, six-tenths of an acre of rape was equivalent to 1330.2 pounds of grain. Therefore, in one case an acre of rape was eqnivalent to 3186 pounds of grain, and in the other, 2217 pounds of grain.

Later, Carlyle, of the same institution, repeated the work, and states: "With pigs from four to ten months old, representing the various breeds of swine, an acre of rape, when properly grown, has a feeding value when combined with a ration of corn and shorts equivalent to 2346 pounds of a mixture of these grain feeds."

The Central Experimental Farm, Canada, reports feeding six pigs on three-sixteenths of an acre of rape from August 14th until snow covered the ground. It is estimated that the rape saved 156 pounds of meal, or an acre of rape would save 832 pounds of meal. This is far short of the Wisconsin returns, but the pigs were young at the commencement of the trial, and it is the writer's experience that young pigs do not make as good pasture as older ones.

Rape vs. Clover.—The Wisconsin Experiment Station reports two trials with pigs on rape and clover. In the first trial there were twenty pigs in each group, and in the second trial twenty-one in each group. The pigs were five to six months old at the commencement. The following table shows gains and food consumed:

	First Trial.		Second Trial.	
	Rape.	Clover.	Rape.	Clover.
	Lbs.	Lbs.	Lbs.	Lbs.
Average daily gain per pig,	.87	.78	1.27	1.22
Amount of grain for 100 lbs. gain,	391	439	322	340

It will be seen that the rape gave somewhat better gains with a smaller meal requirement per 100 pounds gain than the clover, though the difference was not great in the second trial.

Rape vs. Soy Beans.—The Ontario Agricultural College fed soy beans and rape to pigs in pens, the green fodder being cut and carried to the pigs. The pigs were fed meal and skim milk in addition.

An acre of rape furnished 22 tons of green fodder, and an acre of soy beans 15 tons of green fodder.

Soy beans had a higher feeding value per ton than rape, but when the difference in yield was taken into consideration, the two crops proved about equal in amount of pork produced per acre.

Rape has an advantage over soy beans in that it may be sown on a wider range of dates, and retains its green condition for a longer period.

Rape also makes a better pasture crop than soy beans, as it suffers less from trampling.

Clover and Timothy.—In the experiments at the Iowa Experiment Station with supplementary foods with corn, hogs were pastured upon both clover and timothy. Without going into details, it may be said that the experiments indicate that clover produced pork at the rate of 400 pounds per acre, and timothy at the rate of 278 pounds per acre. This is probably more than can be expected from these crops as a general rule.

Hairy Vetch or Sand Vetch.—This crop is very much relished by hogs, and if sown in the fall gives an early pasture of high nutritive value. It may also be sown in the spring, in which case it is rather late in the season before it is ready for pasture, and it does not give the amount of pasture which is desirable. The liability of the crop to winter-kill in some districts when sown in the fall, and the high price of seed, prevent the crop from becoming widely popular.

Fall Rye.—Rye does not make so valuable a pasture as many other crops, and its main feature is its early growth. For supplying pasture very early in the spring a small plot of rye can often be used to good advantage.

Cowpeas.—The cowpea flourishes in the South, where it gives exceptionally good results as a hog pasture. It is frequently sown among corn with the last cultivation, and pastured after the corn is harvested. The Mississippi Experiment Station (Bulletin 100) reports producing from 350 to 483 pounds of pork from an acre of cowpeas. The peas were allowed to become nearly ripe before the hogs were turned in.

Mixtures.—Various mixtures have been used as pasture crops for swine. The writer has used oats and peas, also a mixture of oats, peas and vetches. These crops do not stand pasturing well, and are better suited for soiling purposes.

The Michigan Experiment Station speaks well of a mixture of corn, peas, oats, rape and red clover. There is a good deal of waste in pasturing this crop. If, however, the first crop would be cut for soiling purposes, the second growth would furnish a good deal of pasture.

Artichokes.—The Central Experimental Farm, Canada, reports good results from artichokes. One-sixteenth of an acre was planted on May 19th with about 70 pounds of tubers. The tubers were planted about four inches deep, in rows 24 inches apart, and in hills about 20 inches apart in the rows. Six pigs averaging a little over 100 pounds each were fed a light meal ration while eating the artichokes. The six pigs gained 197 pounds in three weeks, and consumed only 189 pounds of meal. This is a most extraordinary result, but it must be remembered that the experiment lasted a very short time. The experiment certainly indicates possibilities for this crop. Pigs eat artichokes very greedily.

Pasture vs. Soiling.—Some experiments at the Ontario Agricultural College indicate that more rapid gains with a smaller consumption of food per pound of gain can be secured by soiling pigs than by pasturing. This is especially true of young pigs, and the writer's experience leads him to believe that pigs should weigh at least 100 pounds before being turned on pasture to get best results. There is considerable extra labor in cutting green crops and carrying them to the pigs under the soiling system, which brings the two systems fairly close together from the standpoint of economy.

Amount of Grain on Pasture.—Growing or fattening pigs cannot be produced satisfactorily on pasture alone, but a grain ration is necessary. The Montana Experiment Station found that hogs fed a full grain ration on pasture gained, on an average, 1.39 pounds per hog per day, and required 412 pounds of grain for 100 pounds of gain. Hogs fed a half ration of grain, gained .98 lb. per hog per day, and required 291 pounds of grain for 100 pounds of gain. Thus, it will be seen that hogs fed a full grain ration on pasture, made more rapid gains, but consumed much more grain for every 100 pounds of gain.

The Ontario Agricultural College fed two lots of pigs five weeks on clover and ten weeks on rape. One lot received a full meal ration, and the other a two-third meal ration. As in the Montana experiments, the hogs fed a full meal ration made more rapid gains than the others, but they consumed 421 pounds of meal for 100 pounds of gain, as compared with 353 pounds meal for 100 pounds gain in the lot fed the two-thirds ration.

It seems to be clearly demonstrated that it is a mistake to feed hogs all the meal they will eat when upon pasture, unless it becomes necessary to do so near the end of the feeding period in order to fit them for market.

ROOTS.

In Henry's "Feed and Feeding" there is an excellent summary of Danish experiments with roots for swine. The meal equivalent of roots was found to vary in a very marked degree in different trials, and 100 pounds of barley was found to be equivalent to 600 to 800 pounds of mangels, and 400 to 800 pounds of fodder beets. In the United States and Canada, wide variations in the meal equivalent of roots have also occurred in various tests. The following table gives an idea of the range of values found at several stations:

Central Experimental Farm, ...100 lbs. meal—786 lbs. roots.
Ohio Experiment Station, ...100 lbs. meal—642.5 lbs. roots.
Montana Experiment Station, ...100 lbs. meal—529 lbs. roots.
Utah Experiment Station, ...100 lbs. meal—455 lbs. roots.
Ontario Agricultural College, ...100 lbs. meal—441.5 lbs. roots.

The variations in these trials is similar to the variations in the Danish experiments. Ontario obtained a remarkably high meal equivalent for roots, and it is worthy of note that in the Ontario trials the roots were pulped and mixed with an equal weight of meal, the hogs being fed all they would eat of the mixture.

In the writer's experience, hogs fed roots are thriftier looking, and possess better appetites than hogs fed meal alone, and it is no doubt due to their influence upon the general health of the animal that roots are able to make such a favorable showing. The degree to which the general thrift of the animals is injured by exclusive meal feeding will be reflected in the relative feeding value shown by roots and grain, and this fact renders extreme variations quite possible.

Generally speaking, it may be said that sugar beets possess the highest feeding value among ordinary roots, and are most readily eaten by swine. Mangels, Swede turnips and carrots may be counted practically equal in value, but hogs eat mangels with greater relish than they eat turnips.

POTATOES.

At the Wisconsin Experiment Station, 441 pounds of potatoes, cooked and fed to swine, proved equal to 100 pounds of corn meal. In "Feeds and Feeding," Henry summarizes Danish experiments, where 400 pounds of potatoes proved equal to 100 pounds of mixed meal. In connection with these investigations, Prof. Henry says: "In general, we may say that a bushel of corn is worth four and one-half bushels of potatoes for fattening purposes when cooked and fed with corn meal. Potatoes may have a higher value than the rating here given, in furnishing variety in ration to growing animals."

Potatoes must be cooked for swine, and this item of expense cancels some of the advantages which they possess over roots as a food for swine.

PUMPKINS AND SQUASHES.

Pumpkins belong to the same class of foods as roots, giving bulk and succulence to the ration, and thus promoting thrift. J. H. Gris-

dale, Central Experiment Farm, has a high opinion of pumpkins for swine. He says: "We cook them and mix meal with them and I don't think there is anything that will surpass them as a cheap fattening ration." He also states that the pigs like the seeds best, and that no injury comes from feeding the seeds. Excellent results were obtained at the New Hampshire Experiment Station from feeding raw pumpkins with meal and skim milk.

The squash may be counted as equal to the pumpkin in feeding value.

APPLES.

Apples do not appear to possess a high feeding value, but may often be used to good advantage to give variety and succulence to a ration. They are, perhaps, most suitable for mature breeding stock, but a hog should never be expected to subsist upon apples as the main part of its ration.

DAIRY BY-PRODUCTS.

Skim Milk.—The results of nineteen trials with eighty-eight pigs at the Wisconsin Experiment Station are well summarized by Henry in "Feeds and Feeding." It is a well known fact that when a small proportion of skim milk is fed with meal, the milk shows a higher meal equivalent than when a large proportion is fed; that is to say, it requires a smaller amount of skim milk to be equivalent to a given amount of meal when a small proportion of milk to meal is used. Henry summarizes the Wisconsin results as follows:

Proportion of Milk to Meal.	Pounds Milk Equivalent to 100 Pounds Meal.
1 lb. corn meal, 1 to 3 lbs. milk.	327 lbs. milk equals 100 lbs. meal.
1 lb. corn meal, 3 to 5 lbs. milk.	446 lbs. milk equals 100 lbs. meal.
1 lb. corn meal, 5 to 7 lbs. milk.	574 lbs. milk equals 100 lbs. meal.
1 lb. corn meal, 7 to 9 lbs. milk.	552 lbs. milk equals 100 lbs. meal.
Average of 19 trials.	475 lbs. milk equals 100 lbs. meal.

The Ontario Agricultural College reports a trial in which 355.6 pounds of skim milk proved equal to 100 pounds of meal. The proportion of milk to meal was about 2.5 to 1, and the result is similar to the Wisconsin result with a similar proportion of milk to meal.

The Minnesota Experiment Station reports six trials in which the proportion of milk to meal varied, the highest proportion being about 5 pounds of milk to one of meal. The average of these trials gives 467 pounds of milk equivalent to 100 pounds of meal, which is very close to the Wisconsin average.

Utah experiments show 431 pounds of skim milk equal to 100 pounds of grain, and Tennessee experiments 476 pounds of skim milk equal to 100 pounds of grain. The Tennessee results are practically identical with the Wisconsin average, and the Utah results are reasonably close.

These experiments show that where skim milk can be obtained conveniently and in suitable quantity, it has a very considerable value in hog feeding. When meal is worth $20.00 per ton, skim milk is easily worth 20 cents per hundred pounds, unless an exceptional amount of labor is involved in procuring it. For *young pigs,* just after weaning, it is difficult to find a substitute for skim milk, and in such cases its value would be *very much higher* than for older hogs.

Sweet vs. Sour Skim Milk.—Several experiments with sweet and sour skim milk indicate that there is little or no difference in the feeding value of the two products, in fact, the sour milk has, if anything, had the advantage. For very young pigs, sweet milk is preferable.

Whey.—At the Ontario Agricultural College, the writer conducted seven trials with a view of ascertaining the value of whey for pig feeding. The average of these seven trials gives 744.5 pounds of whey equivalent to 100 pounds of meal.

Two trials at the Wisconsin Experiment Station give an average of 800 pounds of whey equivalent to 100 pounds of meal.

These trials probably show the maximum value of whey for pig feeding. Under ordinary methods of feeding it would hardly be safe to expect quite as good returns for whey. Where labor is involved in procuring the whey, due allowance must be made in estimating the value of this product.

Sweet vs. Sour Whey.—Five trials made by the writer failed to show any appreciable difference between the feeding value of sweet and sour whey.

Separated vs. Ordinary Whey.—In an experiment conducted by the writer, ordinary whey proved to be worth twenty-five per cent. more than separated whey. The separated whey had been run through the cream separator to remove the fat for making whey butter.

Buttermilk.—Experiments at the Ontario Agricultural College and elsewhere show that buttermilk is practically equal to skim milk for feeding pigs.

Substitutes for Skim Milk.—For young pigs, just after weaning, it is difficult to find anything that will take the place of skim milk. When skim milk is not available, there is danger of the pigs becoming stunted at this period of their life, especially pigs that are weaned young. The Ontario Agricultural College conducted two trials with Swift's digester tankage and blood meal as substitutes for skim milk. These two foods proved nearly equal in value, and since the tankage costs much less per ton, it was regarded as the most satisfactory.

In the first trial, the tankage constituted about one-fourteenth of the total ration, and in the second trial one-tenth of the total ration.

About two pounds of milk to one pound of meal was fed in each trial.

The average of the two trials shows that to produce 100 pounds of gain, it required:

375 pounds meal and 34 pounds tankage.

390 pounds meal and 727 pounds skim milk.

The pigs getting tankage ate their food quite as eagerly as those getting skim milk, and continued thrifty throughout the experiment.

Tankage, therefore, proved a very satisfactory substitute, so far as gains in weight were concerned, but when skim milk can be obtained at 15 cents per hundredweight, it is cheaper than tankage at prevailing prices.

In other experiments by the writer, the results of which have not been published, other substances, such as linseed meal, "black strap" molasses, and tea from alfalfa hay have been tried, but none of these approached tankage in efficiency as a substitute for skim milk for young pigs.

The Michigan Experiment Station also compared tank with skim milk for young pigs. The pigs on skim milk made slightly larger gains, but when skim milk was valued at 20 cents per 100 pounds, and tankage at $\$1.62\frac{1}{2}$ per 100 pounds, the tankage fed pigs made cheaper gains than the skim milk pigs.

PREPARATION OF FOOD.

Cooking and Steaming.—Years ago there was a popular belief that cooking or steaming feed increased its digestibility, and hence its feeding value. The work of experiment stations and private investigators has thoroughly exploded this idea, and indicates that digestibility may be decreased rather than increased by cooking, in

the case of many foods. There are some foods which are rendered more palatable by cooking, such as potatoes and beans, but in the case of foods which are eaten readily without cooking, it may be taken as settled that cooking or steaming is poor economy. Instead of being a commendable practice, cooking is something which should be avoided as far as circumstances will permit, and employed only when foods are not acceptable in the raw state. Where economy is no object, it may be possible to secure larger gains in weight by cooking a certain portion of the food to make the ration more palatable, thus stimulating the appetite of the animals, but such gains are usually obtained at a comparatively high cost.

Grinding.—The question of grinding was discussed under corn, and it was shown that, so far as corn is concerned, the gain from grinding is comparatively small. Numerous experiments have been made with other grains to determine the effect of grinding, it being generally supposed that grinding would be more effective in the case of small grains than it would be with corn. It is out of the question to review experimental work in detail in regard to this point, but it may be said that grinding small grains, such as peas, barley, oats and rye, has almost invariably proved beneficial. Sometimes the advantage of the ground grain has been very slight, and sometimes very marked, but the general evidence indicates that it is advisable, when practicable, to grind such grains. When the cost of grinding is excessively high, the practice may not be advisable, but, under ordinary circumstances, it is the safe course. According to a compilation of experiment station results, made by G. M. Rommel (Bulletin 47, U. S. Dept. of Agric.), the average saving effected by grinding small grains is 12.26 per cent., which is double the saving effected by grinding corn in the Wisconsin experiments.

Wet vs. Dry Food.—Considerable experimental work has been done with wet and dry food, and results are very contradictory. On the average, the two methods of feeding show practically equal results. The writer's experience is that when hogs can be fed dry meal in such a manner that they cannot waste it, they make as good use of it as when it is wet. There is more tendency to waste feed when it is fed dry, especially when a considerable number of hogs are fed out of the same trough. Troughs arranged so as to prevent crowding, will tend to lessen the waste. In cold pens, dry meal feeding has some advantages, and mixing dry meal with an equal weight of pulped roots makes a good ration. Under ordinary conditions, it is difficult to see much advantage from dry feeding.

Soaking.—Soaking feed is another practice which seems to give variable results according to experimental data. There seems little doubt, however, that in the case of dry, hard grain fed whole, soak-

ing is to be commended. In the case of meal, freshly mixed food will likely give as good results as soaked food.

Fermenting.—The practice of fermenting food for swine used to be much more common than it is at present. In the case of cottonseed meal, it will be remembered that the Texas Station recommends mixing the cottonseed meal with other meal, and allowing the whole mass to sour. The New Hampshire Station obtained better results from fermented bran than from unfermented bran. With foods well adapted to pig feeding, it is not likely that fermentation would be of any benefit.

COST OF RAISING PIGS.

The Ontario Agricultural College obtained some interesting figures relative to the cost of raising young pigs until six weeks old, at which age they were commonly weaned.

Foods were valued as follows: Meal of all kinds, including bran and middlings, $20.00 per ton; roots, $2.00 per ton; skim milk, 15 cents per 100 pounds.

It is assumed that the sow raises two litters a year, and that she nurses each litter six weeks. This would leave about nine and one-quarter months during the year that the sow would not be nursing pigs, and the cost of maintaining the sow during the time she is dry is estimated at 75 cents per month, it being assumed that the sow is fed as economically as possible during this time. The maintenance during the nine and one-quarter months at 75 cents per month amounts to $6.94, or in round numbers, $7.00. Half of this amount, or $3.50, is charged against each litter, in addition to the cost of food consumed by the sow and pigs before the pigs were weaned.

Risk, interest on investment, labor and manure are left out of the calculation.

Twelve litters of pigs were used, which were weaned at six weeks old in each case.

The following table gives particulars of each litter:

Sow and litter.	Number of pigs in litter.	How Bred.	Cost of feeding sow and litter for six weeks.
No. 1,	4	Pure Yorkshire,	$3 20
No. 2,	9	Berkshire sire, Tamworth dam,	3 08
No. 3,	6	Pure Yorkshire,	3 87
No. 4,	5	Yorkshire sire, Tamworth dam,	3 76
No. 5,	8	Yorkshire sire, Tamworth dam,	3 64
No. 6,	3	Yorkshire sire, Berkshire dam,	5 85
No. 7,	9	Berkshire sire, Yorkshire dam,	4 31
No. 8,	8	Pure Yorkshire,	4 73
No. 9,	8	Pure Tamworth,	3 87
No. 10,	8	Yorkshire sire, Tamworth dam,	3 94
No. 11,	6	Tamworth sire, Berkshire dam,	3 33
No. 12,	4	Tamworth sire, Berkshire dam,	2 37
Average,	6½		$3 74

To arrive at the total cost of the pigs at six weeks old, the service fee, and half the cost of maintaining the sow when dry are charged against the average cost of maintaining the sow and litter for six weeks, making the total cost as follows:

Service fee,	$1.00
Half cost of maintaining dry sow (½ of $7.00),	3.50
Average cost of food for sow and litter,	3.74
Total,	$8.24

Average number of pigs in litter, 6½.

Average cost per pig six weeks old, $1.27.

If the cost of maintaining the dry sow were placed at $1.00 per month, it would bring the cost of the young pigs to $1.44 each at six weeks old. It is probably a safe statement, therefore, that young pigs can be raised to the age of six weeks at $1.50 each, making some allowance for items not considered in the experiment described.

J. H. Grisdale, Central Experimental Farm, Canada, estimates that a breeding sow can be maintained during a whole year at from $12.00 to $15.00, under careful management, and produce two litters during the year. This approximates, very closely, the Ontario results, which, omitting service fee, make the cost of maintaining a sow half a year, and one litter of pigs for six weeks, $7.24.

MONEY RETURNS FOR FOOD CONSUMED BY HOGS.

Some interesting figures have been published by the Ontario Agricultural College relating to the value it is possible to obtain for food consumed by hogs, when the hogs are sold at varying prices per pound live weight. The investigation includes hogs fed by the College, as well as a large number fed by farmers throughout the province. The following summary shows the scope of the investigation:

Number of hogs,	297
Weight when marketed,	56,718 lbs.
Average weight per hog,	190.9 lbs.
Total meal consumed, which included barley, peas, oats, corn, middlings, and bran,	165,911 lbs.
Total skim milk consumed,	112,500 lbs.
Total roots consumed,	64,600 lbs.
Miscellaneous foods, such as pasture, green foods, etc., valued by experimenters at	$77.00

The pigs are valued at $1.50 each at weaning time. This amount, together with the value of the skim milk at 20 cents per cwt., roots at 10 cents per bushel, and the miscellaneous foods valued at $77.00 is first deducted from the gross proceeds derived from the assumed sale of the hogs at each of the different prices per pound, and the residue represents the cash received for the meal consumed by the hogs. The following table shows the prices obtained for feed, under each valuation of the hogs when sold:

PRICES REALIZED FOR FOODS CONSUMED BY 297 HOGS.

Assumed Selling Prices of Hogs, Live Weight.	Meal, including mixed grain, middlings and bran.	Milk.	Roots.
	Per ton.	Per cwt.	Per bu.
If sold at 4½ cents per pound,	$20 45	$0 20	$0 10
If sold at 5 cents per pound,	23 87	20	10
If sold at 5½ cents per pound,	27 29	20	10
If sold at 6 cents per pound,	30 71	20	10
If sold at 6½ cents per pound,	34 13	20	10

Figures such as the above, obtained from a large number of hogs fed under varying conditions, carry considerable weight. They show that the hog is able to give a good account of the food he con-

sumes, provided he is handled with intelligence. Of course, the figures in the table are averages. Some experiments showed larger returns, and some did not show as large, but it is worthy of note that two experiments which showed exceptionally good results were omitted from the computation in order to make the results as conservative as possible.

FEEDING AND MANAGEMENT.

THE BOAR.

Use.—The age at which a young boar may be first used depends largely upon his development. Some boars may be used to a few sows when not more than seven months old, without apparent injury. As a rule, it is safer not to use a boar before he is eight months old, and to use him as sparingly as possible until he is a year old. No hard and fast rule can be laid down and the owner must use his judgment in the matter. Excessive use when young is likely to shorten the period of a boar's usefulness, and since a boar will usually leave the best pigs after he reaches maturity, the importance of saving him while he is young will be readily appreciated. Some good breeders will not allow more than one service a day, with intervals of one or two days a week without being used, in the case of valuable boars. This is a matter which can be regulated better in large herds where several stock boars are kept, than it can where only one boar is kept, and where outside sows are admitted. The owner of a boar under the last named conditions will require to exercise all his ingenuity to prevent his boar from being used too freely during certain seasons of the year. In no case should more than one service to a sow be permitted, and the boar should not be allowed to run with sows to which he is to be bred. Excessive use is likely to result in small, weak litters, and the aim should be to save the boar from all unnecessary service. It is not good to use a boar immediately after he has been fed.

Exercise.—Probably nothing is more essential to the health and vigor of an animal than exercise. In summer, it is usually a comparatively simple matter to provide exercise in a paddock or pasture lot, but in winter it is more difficult. A roomy pen should be provided, with a sheltered outside yard. When practicable, it is a good plan to feed the boar outdoors at some distance from his sleeping quarters, thus compelling him to take exercise in walking back and forth between his pen and the feeding place. Icy ground is the

greatest drawback to this method, but this can be overcome by littering the walk with some straw horse manure. Sometimes the boar can be fed in a well littered barnyard, which makes a very good arrangement when practicable. When several boars are kept, it is difficult to provide separate runs for each boar, and it simplifies matters if they are taught to run together. The tusks should be removed and a cool day should be selected for turning them together for the first time. It takes a very short time, as a rule, to settle the questions of supremacy, and when once settled no further disputes arise. The writer has had considerable experience with this method, and has never known bad results to follow. Two conditions are necessary, the tusks must be broken off, and a cool day selected for the tournament. After the first struggle, the boars will live together as peaceably as sows.

Removing Tusks.—Armed with long, sharp tusks, the boar is capable of inflicting serious injury upon man or beast, should he take the notion, but, deprived of his tusks, he becomes comparatively harmless. It is the part of wisdom, therefore, to remove these tusks before any damage is done, because we never know what the quietest boar may do under provocation. Several methods may be employed, and the following one will answer very well. The boar is first made fast to a post by means of a rope noosed about his upper jaw back of the upper tusks. Then, one man takes a crowbar and another a sharp cold chisel and a hammer. With a pair of mollar cutters cut them off close to the gum.

Feeding.—It requires good judgment to keep a boar in the best possible condition. Extremes are to be avoided. The over-fat boar does not make a satisfactory sire, as a rule, and a half-starved boar cannot transmit vigor and constitution to his progeny to the same degree that he would if properly managed. To get the best results, the boar should be in fair flesh. A reasonable amount of fat on his bones will do him no harm if he gets sufficient exercise.

An exclusive meal ration will not give good results, especially if the ration is made up of corn. It is true that corn can be fed to a boar without injuring him, but it must be fed in the right way. Corn is fattening, but its exclusive use is debilitating, and the feeder must combine something with it to get good results. Equal parts ground corn, ground oats, and wheat middlings, make a good meal ration. Equal parts ground oats and middlings, make a first-class meal ration when corn is not used. It gives sufficient bulk, and is nutritious without being heating, or too fattening. Ground oats, middlings, or bran may be used singly to dilute corn; in fact, a very great variety of grains may be fed, so long as the feeder uses judgment.

But a boar needs something besides meal if he is going to do his best. Skim milk and buttermilk are excellent, and will give good results with corn though nothing else may be used. In winter, roots of any kind are much relished. They have a cooling, laxative effect, preventing constipation and keeping the animal thrifty and vigorous. If roots are not available, alfalfa hay of fine quality, or even fine red clover hay may be used to give bulk to the ration. Some feed the alfalfa hay dry in racks, and others prefer to cut it and soak it with the meal ration, or scald it with boiling water before mixing with the meal. As a substitute for roots, the soaked or steeped alfalfa would be preferable to the dry hay. Alfalfa or clover hay may be fed along with roots, and will be found to give good results if the feeder takes care to supply a reasonable amount of concentrated food to make the ration sufficiently nourishing.

Summer management is usually simpler than winter. A pasture lot provided with shade is one of the best places to keep a boar. The grass or clover, or whatever the pasture may consist of, will furnish the bulky, succulent food necessary for health, and gathering part of his food from pasture compels the boar to take exercise. If it is not possible to provide pasture, he should be liberally supplied with green food in his pen.

The quantity of meal to feed a boar will vary with circumstances. During the season when he is used most, he will require liberal treatment, but at no time should he be fed more than he will eat up clean before leaving the trough. During comparatively idle seasons, a very light meal ration will be sufficient, and if on good pasture, he will require but little food in addition. It is entirely a matter of judgment, and the feeder must be guided by the condition of the boar. It is never wise to make sudden changes in the ration, that is, to change suddenly from a light ration to a heavy one, or from a heavy ration to a light one. Changes should be made gradually and the feeder, knowing about when the heaviest season commences, should start in plenty of time to prepare the boar for it.

THE SOW.

Age of Breeding.—The age at which a young sow is first bred will depend upon her development, but it is very seldom that it is advisable to breed her before she is eight months old. Many good breeders prefer not to breed sows before they are ten, or even twelve months old, and if they are intended for show purposes, it is scarcely advisable to breed them earlier. One of the great objections to breeding sows very early is the fact that the very young sow is seldom able to raise a fair sized litter of pigs, and if she raises only a few

pigs in her first litter her mammary glands do not develop properly, and she rarely makes as good a nurse with subsequent litters as the sow which raises a good sized first litter. Another objection to early breeding is the fact that the very young sow has not the strength to stand the strain of nursing a litter of pigs, and her vitality is sapped to such a degree that she never develops as she should. As a result, she will not retain her usefulness for so long a period, nor is she so likely to give strong, vigorous litters as though she had possessed more maturity before being bred.

Breeding Mature Sows.—Many sows will accept service a few days after farrowing, but it is hardly necessary to say that to breed a sow at this time is bad practice. No sow can do justice to herself and two litters of pigs at the same time, and the man who attempts to gain time by following such a practice will surely lose by it in the end. Usually, the sow may be bred again a few days after her pigs are weaned, if not too much pulled down in condition by nursing. If she has raised a large litter and is very much emaciated, the chances are that she will produce a small litter the next time, if she is bred immediately after the pigs are weaned. In such cases she should be given three weeks or a month of liberal feeding to enable her to regain something of her lost strength and vitality before she is bred. Though the sow need not be fat, she should be in good heart and thriving at the time she is bred. Many a man has been puzzled to know why his sow, which has raised a large litter, should drop down to four or five pigs the next time. The reason is not difficult to find, because a sow must be strong and full of vitality at the time of service in order to produce a large, vigorous litter.

Period of Gestation.—The period of gestation in sows is usually placed at 112 days. Often, young sows will farrow a few days sooner than the stated time, and old sows will frequently go a few days over it. It is not a good sign when a sow goes much over the sixteen weeks, as the litters are often lacking in vitality when carried much over time. If a sow has been properly handled, she will seldom go more than a few days over sixteen weeks, though there are exceptions to all rules.

Best Time for Farrowing.—Where winters are at all severe, it requires exceptional skill and equipment to make a success of winter litters. Most farmers will find it safer to have their sows farrow in April and October. It is generally possible to give April pigs a little outdoor exercise at an early stage of their growth, which will be found a great help in keeping them healthy and thrifty. The October pigs will also be able to get outdoor exercise for a time, which will enable them to get a good start, and make them better able to endure the closer confinement necessary during winter.

One or Two Litters.—The man who is breeding for show purposes, and who wishes to have his pigs on the sow as long as possible, as well as get his sow into high condition between litters, will find it necessary to breed his sow only once a year; but the general run of farmers will require their sows to do more than this, and there is no good reason why a sow should not produce two litters a year when properly handled, provided that the sow is not to be fitted for the show ring.

Exercise.—Though exercise is imporant in the case of the boar, it is doubly important with sows during the period of gestation. Without considerable exercise during this time, sows cannot be made to give satisfactory results. In summer, pasture should be provided in which there is plenty of shade. A good pasture affords ideal conditions for sows, the green food and the exercise keeping the sows in the best possible condition.

The greatest difficulty will be encountered in giving the sows sufficient exercise during the winter. Where only a few sows are kept, it is often possible to give them the run of a barnyard, where they will take exercise rooting among the manure, or working among scattered straw or chaff to find what little grain it may contain. If a dry, well bedded sleeping place is provided, which is free from draughts, the conditions are about as good as can be obtained. When it is impossible to use the barnyard, a roomy shed with earth floor and a sleeping place arranged in one corner, can be made to answer the purpose very well. By littering the shed with cut straw or chaff, and sprinkling a very little whole grain among the chaff every day, the attendant can induce the sows to take considerable exercise. Another method is to use portable pens set in outside lots. The pens should be placed facing south, and fifty yards, or more, from the feeding place. If kept well bedded, and banked about the bottom with strawy horse manure, they make comfortable sleeping quarters. The sows are forced to take exercise in walking backwards and forwards between the pen and the feeding place. It is better to keep not more than five or six sows in a pen of this kind, and care should be taken to provide plenty of trough room. The troughs should be placed on dry ground, or on a platform, and it is preferable to have them in a place that is sheltered from the wind.

Feeding and Management During Gestation.—During the period of gestation the sow should be kept in good, strong condition, but not overloaded with fat. Extremes in condition are to be avoided. The very fat sow is apt to be clumsy with her pigs, and sometimes her pigs are few in number or lacking in vitality. On the other hand,

the very thin sow will either not do justice to her pigs, or will become a mere wreck herself during the time she is nursing her litter, and the chances are that both these things will happen. A sow may be kept in fairly high condition and still produce satisfactory litters, provided she takes plenty of exercise.

In districts where corn is plentiful, there is a temptation to feed sows almost exclusively upon corn. Such a method of feeding cannot give the best results, besides corn does not furnish enough bone and muscle forming constituents to properly develop the unborn pigs. It is also rather too fattening and heating to feed in large quantities to a sow at this stage. It is true that corn may be fed, but, as in the case of the boar, it must be fed with judgment. The ration recommended for the boar, namely, equal parts ground corn, ground oats, and wheat middlings, will answer very nicely for the sow. The proportion of corn is better to be not over one-third of the meal ration, and wheat middlings or bran may be used to dilute the corn meal without oats. In cold weather, if sows have a good deal of outdoor exercise, they may be fed more corn with safety than when they are kept pretty closely confined. A meal ration which is preferred by the writer to all others, is equal parts ground oats and middlings, leaving out corn altogether. It is possible, however, to use a wide variety of foods, so long as the feeder realizes the importance of furnishing considerable bulk, and of restricting the proportion of heating or highly fattening foods.

As in the case of the boar, the sow requires something besides meal, and the furnishing of some such foods as roots, or alfalfa or red clover hay, is even more important than in feeding the boar. Skim milk is also excellent, but is not often available for sows.

In summer, a pasture field will furnish the bulky part of the ration, and if sows are in good condition to start with, and are given a good pasture, they will get along very well without other food for two or three months. They should be given a little meal for several weeks before farrowing to accustom them to its use, and render the change less violent when they are taken into the pens. With regard to the quantity of meal, the feeder must be guided entirely by the condition of the sows.

Meal may be fed either wet or dry. When roots are fed, a good plan is to mix the dry meal with pulped roots, though the feeder has wide latitude in regard to the methods he may see fit to follow. When sows are fed outdoors in cold weather, very little water should be used in mixing their feed. It will be found better to furnish them with water separately, should they require it. If they are fed roots, they will take very little water in cold weather. It should be seen

to, however, that they have water when they need it, and in hot weather, an abundant supply of fresh water is very important.

A record should be kept of the date of service of each sow, so that the date of farrowing will be known in advance, and due precaution taken. A week or two before farrowing, the sow should be placed in the farrowing pen so as to become accustomed to her surroundings and changed conditions before the pigs are born. Constipation is the bane of the swine breeder, and if the sow becomes constipated before she farrows, the chances are that she will lose her pigs, and possibly her own life. Constipation, therefore, is one of the main things to be guarded against at this time. When it once occurs, very little can be done to successfully overcome it and save the pigs, so that it is almost altogether a matter of prevention. If a sow is taken directly from a pasture field, shut up in a pen, and fed upon an exclusive meal ration, trouble is almost sure to occur. Radical changes in feeding are to be avoided, and the ration should be kept practically the same after taking the sow into the pen as it was before. If anything, the food should be made rather more sloppy, and green feed or roots should be supplied the same as they were before the sow was taken in. A small amount of linseed meal (oil meal) or ground flaxseed added to the ration is also helpful in preventing constipation. The wisdom of feeding sows meal on pasture for a time before they farrow can be readily appreciated, as it prevents a violent change in their ration. The sow should also be given a chance and encouraged to take exercise.

The farrowing pen should be dry, well ventilated, and free from draughts. It is a good plan to provide the pen with a guard rail made of two by eight inch planks fastened with their edges against the sides of the pen adjacent to the bed. These prevent the sow from lying against the partition, and lessens the danger of injury to the little pigs, which often find the space under the guard a very convenient refuge. There is a difference of opinion as to the amount of bedding which should be used, some maintaining that the sow should be liberally supplied with bedding, and others that the bedding should be limited. The writer's experience is that active sows in comparatively light condition can generally be trusted with a liberal amount of bedding, but sows which are in high condition, or which are at all clumsy, had better be given only a moderate amount of straw. Sows should not be allowed to farrow in a large piggery where many other pigs are kept, unless it is warm weather and windows and doors can be left open. The air of a piggery where many pigs are kept seems to be poisonous to little pigs, when the weather is cold and the doors and windows have to be closed, in spite of ordinarily good methods of ventilation. The writer has had

good results from sows farrowing in portable single pens placed in a sheltered yard, even in zero weather. Tarred paper was put on the studding, and the pen tightly boarded outside and inside. A ceiling of slats was put in the pen, and the space above the ceiling stuffed with straw. A window in the side, a small ventilator running from the ceiling out through the roof, and a lighted lantern hung in the pen on the coldest days when the pigs were very small, completed the equipment. The air in this pen always felt dry and comfortable, and the pigs all kept healthy and thrifty.

It pays to treat sows kindly and to have them quiet. If they are on good terms with the attendant and regard him as a friend, there is much less danger of trouble from nervous, excited sows when the critical time of farrowing arrives.

Feeding and Management After Farrowing.—After farrowing, the sow should not be disturbed, and if she lies quiet for ten or twelve hours, or even more, so much the better. When she wants anything, she will come to the trough for it. At first, she should have little more than drink. A very thin slop of middlings and water will answer very well. If the weather is cold, tepid water should be used. During the first three days great care must be exercised not to overfeed, and the ration should be very light. After this, the food may be gradually increased, taking a week or ten days to reach full feed. A good mother with a large litter requires very liberal feeding, but if the litter is small, it may be necessary to reduce the feed.

Many different rations are used for nursing sows. Equal parts of finely ground oats and wheat middlings, allowed to soak between feeds, makes a most excellent ration. If sweet skim milk can be added to the mixture, it makes an almost ideal ration. Corn may be used as recommended for sows before farrowing, and in larger quantities if skim milk is available. A certain amount of roots and green feed are always in order, but the sow should not be expected to subsist upon such foods at this time. A limited amount of bulky, succulent food helps to keep the sow healthy.

If the sow's udder becomes hard and inflamed, it is a good plan to bathe thoroughly with hot water, and apply equal parts of lard and turpentine.

When the pigs are weaned, the food should be cut down to check the secretion of milk. Dry oats make a safe food for the sow for a few days after the pigs are weaned. If the udder gets very full, it is a good plan to turn the sow in with the pigs once a day for a few days.

Sows Which Eat Their Pigs.—Occasionally a sow will be found which will eat her pigs. It is claimed by some that the tendency to eat their young is sometimes caused by allowing sows to eat the after-

birth. As a precautionary measure, the afterbirth should be promptly removed from the pen, but there is little doubt that the trouble is generally caused by a fevered condition in the sow, often induced by injudicious feeding before farrowing, or even after farrowing. A remedy that has been suggested is to feed the sow salt pork, but the danger is that once the sow has eaten her pigs she acquires the habit and is likely to do it again. Unless she is a very valuable sow, it is safer not to give her a second opportunity, but to turn her into the feed lot and fatten her for the butcher.

THE YOUNG PIGS.

Feeding and Management Before Weaning.—When the pigs are born the attendant should be on hand to see that everything goes well. If the pigs are strong, and the sow lies quiet, it is better not to interfere. Sows that have been properly fed and given sufficient exercise seldom have difficulty in farrowing. If the pigs seem somewhat weak, or if the sow is very restless, it is safer to place the pigs in a well bedded box or basket to keep them out of the way until all are born. If the pen is chilly, a bottle of hot water placed in the bottom of the basket and covered with a blanket, with another blanket over the top of the basket, will help keep up the vitality of the pigs. The pigs should be placed to the teat to suck as soon as possible. The weaker the pigs, or the colder the pen, the more important an early drink of the mother's milk becomes. If parturition is not unduly protracted, and if the pigs are strong, lively and comfortable, they may wait for their first drink until all are born, but in such matters the attendant must use his judgment. In cases of difficult parturition, a pig that is apparently lifeless can often be revived by opening his mouth and blowing into it. To be successful, this operation must be performed as soon as he is born. A chilled pig can some times be revived by immersing up to the neck in water heated to the temperature of about 98 degrees. When removed from the water he should be rubbed dry, and induced to suck if possible. As soon as the sow appears to have settled down quietly, it is best to put the little pigs with her and leave them together. It is well not to interfere except when it is absolutely necessary.

By the time the pigs are about three weeks old they will have learned to eat. If at all possible, it is a good plan to give them access to another pen in which is kept a small trough. Here they can be fed a little skim milk with a very little middlings stirred into it. The quantity of middlings can be increased gradually as the pigs grow older. If they can be taught to nibble at sugar beets or mangels during this time, so much the better. A small amount of soaked whole corn, or almost any other grain, scattered on the floor of the

pen, will cause them to take exercise while hunting for it. If it is not possible to provide an extra pen, the sow may be shut out of the pen while the pigs are being fed. Many people simply allow the young pigs to eat with the sow, and many good pigs are raised in this way, but better results will be obtained if the pigs can be fed separately. Exercise is very important for young pigs, and every possible means of securing it must be adapted. If they are kept in a small pen with the mother, some of the best of them will likely become too fat, and will probably sicken and die. Outdoor exercise is especially beneficial, but the pigs should be protected from cold winds, or from a very hot sun. If the sow is turned out with her pigs, it is not well to give her a very large range at first, as she is likely to travel too far and unduly tire the pigs.

Boars not intended for breeding purposes should be castrated before weaning to get the best results, though there is not much danger from castrating at a later date provided care is exercised in connection with the operation. Clean hands, a clean knife, and the use of a disinfectant upon the wound, will obviate practically all danger.

Feeding and Management After Weaning.—There is considerable difference of opinion as to the best age at which to wean pigs. Some advocate leaving the pigs with the sow for ten or twelve weeks, in fact, the sow is allowed to practically wean her own pigs. For producing show pigs, this method may answer very well, but it means only one litter a year; at any rate, it does not admit of two litters a year, and the average farmer will find it more profitable to wean his pigs early enough to permit two litters to be raised. If the young pigs have been taught to eat as described, and skim milk is available, they may be weaned successfully when six weeks old. It is true that many pigs are weaned before they are six weeks old, but it is seldom advisable to do so if they appear to be thriving upon the sow. If skim milk is not available, it is generally advisable to defer weaning for two weeks more, and special pains should be taken to have the pigs well accustomed to their new feed and eating heartily before they are weaned.

Skim milk and middlings make about the best food for young pigs after weaning. If the middlings art fine and floury, which is not too likely to occur under present day methods of milling, they will sometimes cause indigestion, which may show itself either in the form of diarrhoea or constipation. Diluting the middlings with a little bran or finely ground oats will help prevent the trouble. Soaking or scalding the middlings will also tend to prevent digestive troubles. Scalding the middlings is especially useful when no skim milk is to be had, as it makes the food more palatable. To scald the mid-

dlings, it is best to pour boiling water on them, cover the vessel, and allow to stand several hours, or from one time of feeding until the next. When the pigs are first weaned, it is better to feed four times a day, giving only a small quantity of food each time, and taking care to keep the trough clean. When well started, they may be changed to three feeds a day.

It is not well to be in a hurry to commence feeding corn, but if skim milk is fed, corn feeding may commence earlier than when no skim milk is available. Generally speaking, when pigs are about three months old, a little corn or other grain may be introduced into their ration. Two parts of middlings and one part of corn meal or ground barley, mixed with skim milk to form a slop, makes an excellent ration for growing pigs. As the pigs grow older, the proportion of grain to middlings may be increased, but at no time should they be fed exclusively, or almost exclusively upon corn, because corn is a poor bone and muscle former. The importance of feeding supplementary foods with corn has been pretty fully discussed under the work of experiment stations, and need not be dwelt upon here. A few roots will be found most helpful in keeping young pigs healthy during the winter, and green food of almost any kind will answer the purpose during the summer. The feeder has a wide range of foods to choose from, and if he understands something of their nature, he should have no difficulty in compounding a ration which will give satisfaction. The aim should be to develop bone and muscle during the early stages of growth, and while the pigs should be thrifty, and sleek in the hair, they should not be fed in such a way as to overload them with fat. This is especially true of pigs which are intended for breeding purposes, and which should be carried right through to breeding age upon foods which stimulate growth and general vigor rather than fat. A reasonable amount of fat is not objectionable, but the development of the frame, the muscular system, and the vital organs must not be neglected, if a satisfactory breeding animal is to be produced. Variety in foods and plenty of exercise are very essential features in raising an animal that will possess all round development.

FATTENING.

Many of the problems connected with the fattening of hogs are discussed under experiment station work. Corn may be used much more freely for fattening hogs than for those intended for breeding, but experiments show conclusively that corn has its limitations, even for fattening, and that it is greatly improved by having some food

richer in protein combined with it. The importance of using some sort of supplementary food with almost any meal ration in order to give bulk and variety has also been demonstrated, and the important place which pasture may play in the fattening of hogs has been quite fully dealt with. Little remains to be said under this heading, therefore, except a few general facts of more or less importance.

Winter Feeding.—Generally speaking, winter feeding is more expensive than summer feeding. Part of the extra food required in winter is probably due to the fact that more food is required to keep up the heat of the body during cold weather. There is little doubt, however, that much of the advantage of summer feeding is due to more sanitary surroundings, that is, more fresh air and outdoor exercise, coupled with more succulent food, which seems to aid digestion. The man who feeds hogs in winter, therefore, should aim to approach summer conditions as nearly as possible. He cannot get summer temperature, it is true, but he can provide a fair amount of fresh air, and foods that will keep the digestive organs in good condition. It is just here that the man who grows a few roots for winter feeding has a great advantage over the man who does not. Skim milk, buttermilk, and alfalfa hay may also be made to perform a useful part in giving variety and aiding the digestive organs to perform their functions properly.

Quantity of Feed.—The test of the skill of the feeder is his ability to keep just slightly within the appetite of the animals under his charge. He must watch the animals closely and see that they clean up with apparent relish all that he gives them. Food left in the trough is a sign that something is wrong with the methods employed, and to have to cut back in the quantity of food means a loss of time. The quantity should be so gauged that there is a gradual increase as fattening advances, and radical changes, either in quantity or kind, should be avoided. To be successful, the feeder must learn the lesson that all changes should be made gradually, and that undue haste in fattening may mean serious delay in the process, together with a waste of food.

Regularity and Comfort.—Regularity in time of feeding is necessary to regularity in the appetite of the animal. The animal which is fed at the same hour every day will take more food with less danger of surfeiting than the one fed at any time to suit the convenience of the feeder.

Dry, comfortable quarters, and sanitary conditions generally in pen or feed lot, are important factors in securing satisfactory gains, and in avoiding disastrous loss through disease.

Cost Increases with Age.—Prof. Henry in "Feeds and Feeding" gives a very instructive table compiled from the results from numerous experiment stations, showing the food consumed per 100 pounds gain by hogs of different weights. Following is an abbreviation of the table as given in Professor Henry's book:

Weight of Animals in Pounds.	Total number of animals fed.	Average feed eaten per day.	Feed eaten daily per 100 pounds live weight.	Average gain per day.	Feed for 100 pounds gain.
15 to 50,	174	2.23	5.95	.76	293
50 to 100,	417	3.35	4.32	.83	400
100 to 150,	495	4.79	3.75	1.10	437
150 to 200,	489	5.91	3.43	1.24	482
200 to 250,	300	6.57	2.91	1.33	498
250 to 300,	223	7.40	2.74	1.46	511
300 to 350,	105	7.50	2.35	1.40	535

The table shows that the heavier hogs made more rapid gains and consumed less feed per 10 pounds of their live weight, but there was a steady increase in the amount of food required for 100 pounds gain as fattening advanced.

A similar result was obtained at the Ontario Agricultural College with 36 pure bred pigs of different breeds, as shown by the following table:

Live Weight of Hogs.	Meal required for 100 lbs. Increase in Weight.
54 to 82 pounds,	310 pounds.
82 to 115 pounds,	375 pounds.
115 to 148 pounds,	438 pounds.
148 to 170 pounds,	455 pounds.

These figures, together with others that might be given, show very clearly that the *heavy hog has little to commend him to the feeder.*

Correctives.—Swine appear to have a craving for what might be called "unnatural" substances. This is especially true of hogs which are kept in confinement, which will eat greedily such substances as charcoal, ashes, mortar, soft coal, rotten wood, etc. It is probable that some of these substances are not good for hogs, but there is no doubt that charcoal and wood ashes have a beneficial effect. Charcoal made from corn-cobs answers very well. It is a good practice to supply hogs with charcoal, especially during the winter months, but if the hogs have not had any charcoal for a considerable time and

are then given a liberal supply, there is danger that they may take too much for their own good. The same caution must be observed in regard to salt. If charcoal is not available, a very good mixture to keep constantly before hogs in small troughs made for the purpose can be made up of one part salt, one part sulphur, and about ten parts wood ashes. Sods make a very fair substitute for charcoal. A wagon-load or two of sods placed conveniently near the piggery so that the feeder can throw one or two into each pen occasionally will be found very beneficial during the winter. Hogs that are outdoors during the summer and have access to earth and vegetable matter have little need of other correctives.

BUILDINGS.

The question of buildings for swine is such a complicated one that it seems almost a hopeless task to attempt a discussion of the subject. Almost every piggery that is built, possesses certain features peculiar to itself and rendered necessary by the circumstances which it is intended to meet. All that can be attempted is to discuss the most desirable features of a piggery, for the general guidance of those who wish to build, but every man will have to adopt his building to his own peculiar requirements.

The most important qualities of a piggery are dryness, ventilation, light, freedom from draughts, reasonable warmth, and convenience.

Dryness.—Dryness is closely associated with ventilation, but is also influenced by the material of which the building is constructed. Good results cannot be obtained in a damp pen, and dripping walls are pretty sure indication of impending disaster. Stone and cement walls are very cold in winter and chill the air of the pen, causing it to deposit its moisture upon their surface. In a short time the wall becomes quite wet, and trouble is stored up for the pigs. A hollow cement wall is much less objectionable than a solid one, but there is little doubt that wooden walls constructed in such a way as to form a complete dead air space in the center are the best. The floors and foundation may be constructed of cement concrete, and the foundation may rise about two feet above the surface of the floor. This will preserve the wood of which the walls are constructed and is not likely to prove at all injurious to the pigs. A very good wall can be made by setting two-by-four scantlings on end, and first boarding inside and out with rough lumber. This rough lumber should then be covered with tarred paper, and then the walls should be tightly boarded up with matched lumber. If preferred, the out-

side of the pen may be clap boarded, or boarded up and down with good lumber and battens placed over the cracks. Matched lumber is best for the inside of the pen. If it is thought desirable to have a loft over the pen, the ceiling can be made of poles, placed a few inches apart, and well covered with straw. The straw absorbs the moisture and helps to keep the pen dry. Where this is done the straw should be renewed at least every year, otherwise it becomes a harbor for dust, and, possibly, disease germs.

Ventilation.—Thorough ventilation is a great help in preserving dryness, but it is a difficult thing to secure in a piggery without unduly lowering the temperature. It is an aid to ventilation to provide a large air space; in other words, to have a high ceiling. The tendency at present is to do away with the common loft over the piggery, and to have the space above the pigs extend to the roof. This gives more air space and makes ventilation a simpler problem, but it necessitates lining the under side of the rafters with matched lumber in order to prevent the pen from becoming too cold. The admission of fresh air can be provided for by constructing shafts in the walls at intervals of fifteen or twenty feet. These shafts should not be more than about four by six inches in size, and should open outside near the ground, and inside at the ceiling. Provision should be made for closing, or partial closing, of these intakes when cold air is admitted too rapidly. The outlets may consist of shafts about eight inches square extending through the roof and equipped on the top with a device for preventing the wind from blowing down the shafts. If a feed cooker is used, it can be utilized to great advantage in assisting ventilation. If the building is not a very long one, the chimney may be constructed at the opposite end of the building from the feed cooker, and the pipe from the feed cooker run the whole length of the building before it enters the chimney. In a long building, the chimney may be placed about the center, so as not to have too great length of stove pipe. The heat from the stove pipe has a wonderful influence in aiding the circulation of air in the pen, as well as modifying the temperature and helping to keep the air dry. In fact, where winter litters are raised in large pens, some such device as this is absolutely necessary.

Light.—Light, especially sunlight, has a wonderful influence in promoting health. So far as possible, the windows should be on the south side of the building, because the south side gets the most sun and is least exposed to cold winds.

Draughts.—While ventilation is necessary, draughts are extremely injurious, and their prevention should be kept in view when building.

Warmth.—Warmth is a good thing, but it should not be secured at the expense of ventilation. A somewhat cold pen, well ventilated but free from draughts, is preferable to a warm pen where the air is damp and foul, and the pigs will suffer less discomfort in the former than in the latter. Very young pigs require warmer quarters than older ones, and when a sow farrows in winter, special pains should be taken to secure warmth and freedom from draughts. If she is in a larger piggery, it is often a help to lay poles across the tops of the partitions over the bed, and then cover these poles with straw.

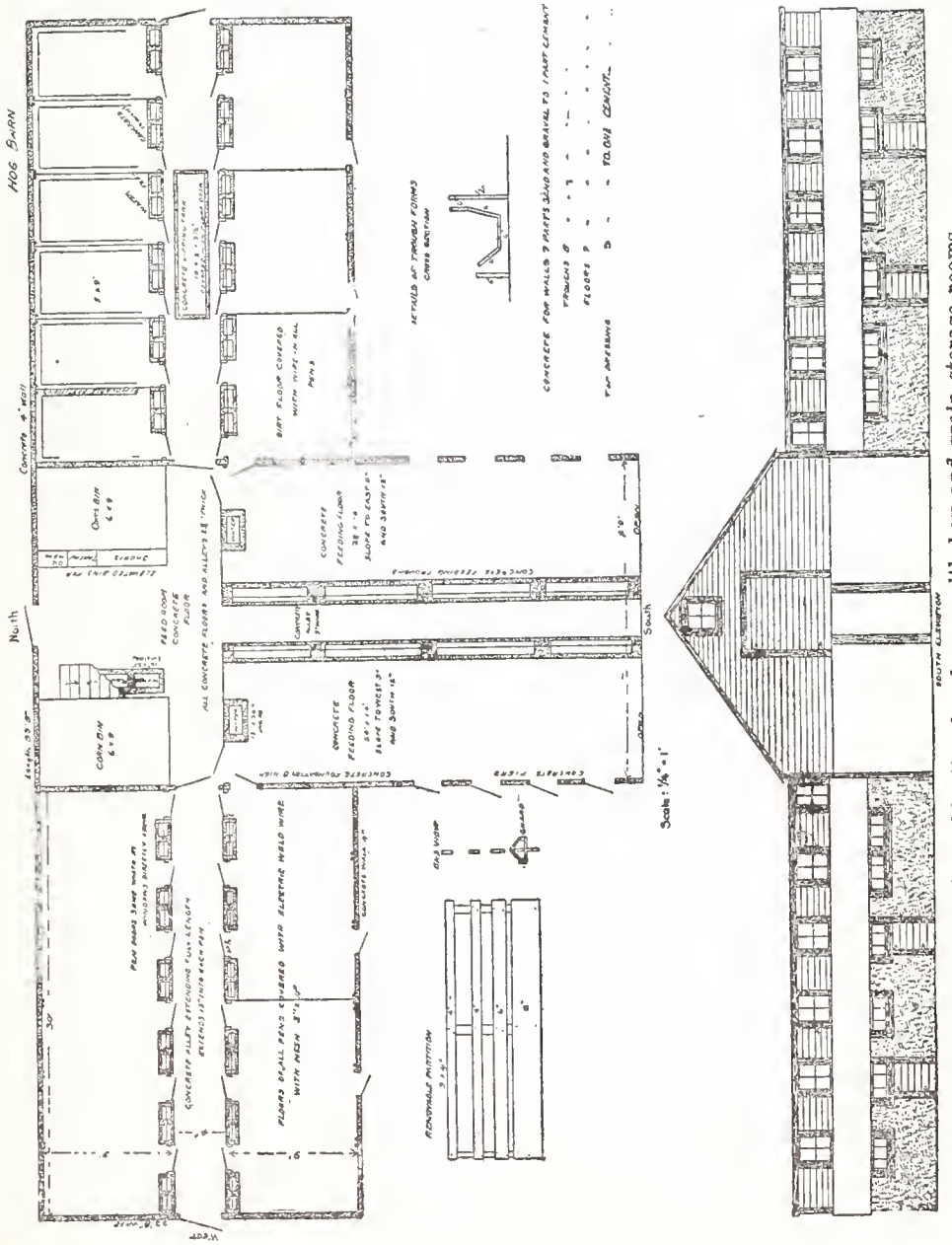


FIG. 11.—A combination hog house, with hay and grain storage rooms.

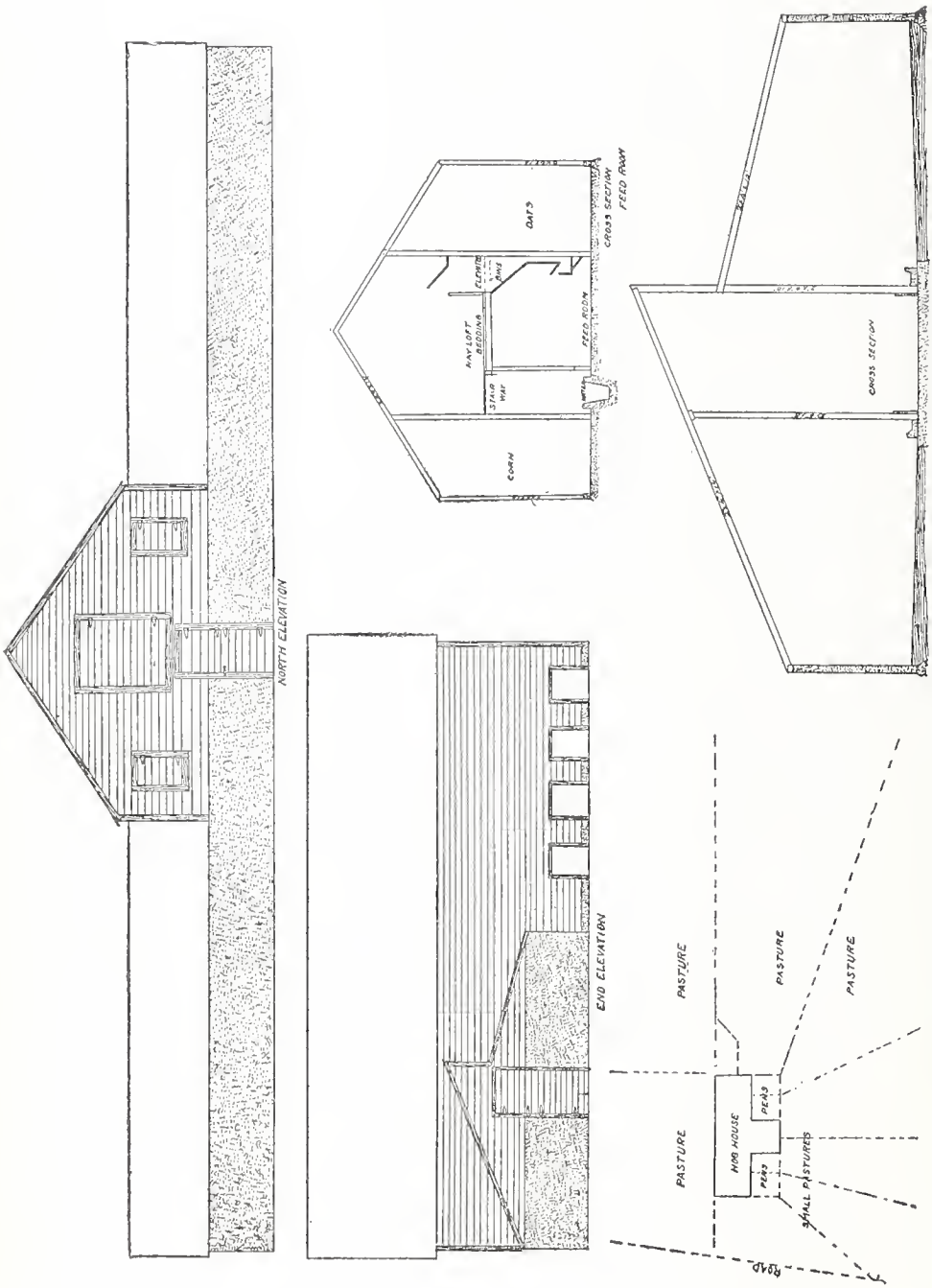


FIG. 12.—Cross sections and elevations of house shown in figure 11.

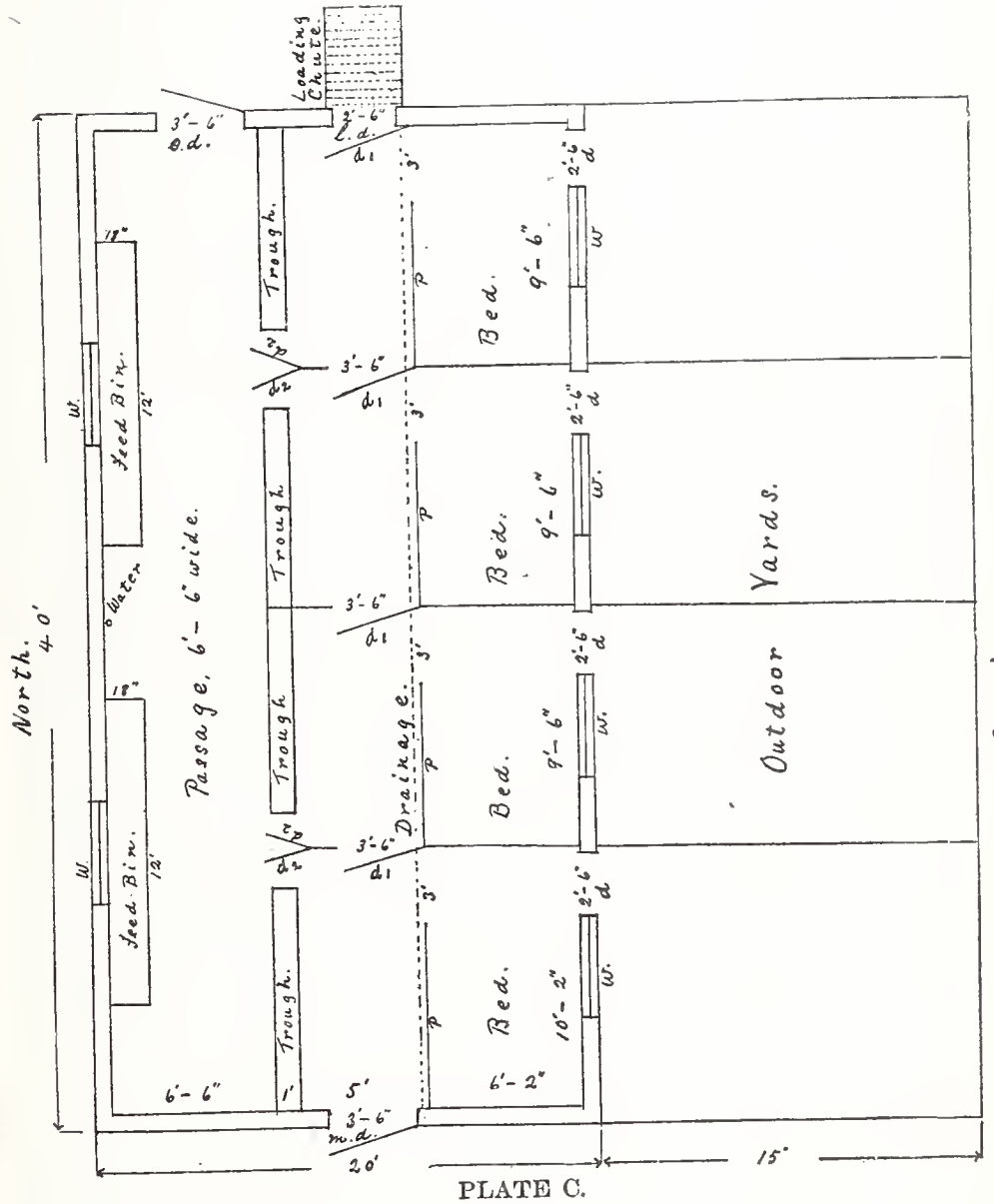
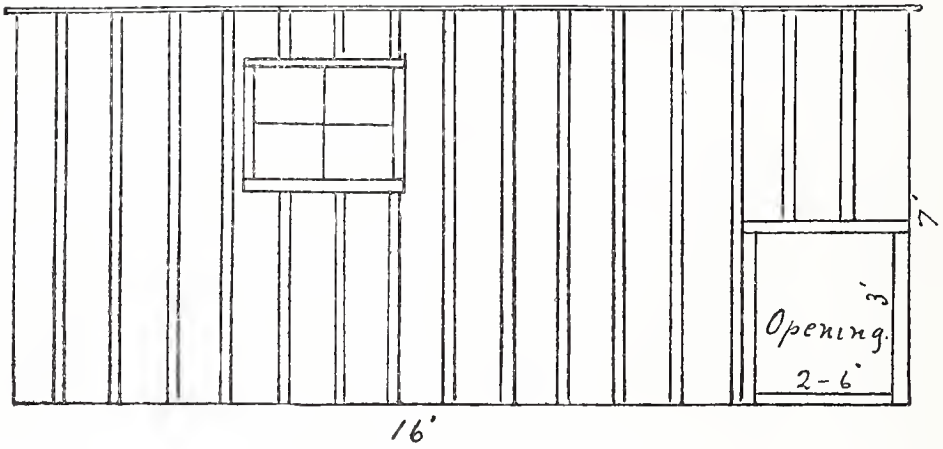

North.
40'
South
Passage, 6'-6" wide.
Feed Bin.
Feed Bin.
Water
Trough
Trough
Trough
Trough
Loading Chute
3'-6" o.d.
3'-6" i.d.
3'-6" m.d.
Bed.
9'-6"
Bed.
9'-6"
Bed.
9'-6"
Bed.
10'-2"
6'-2"
Drainage.
Outdoor Yards.
6'-6"
5'
1'
20'
15'

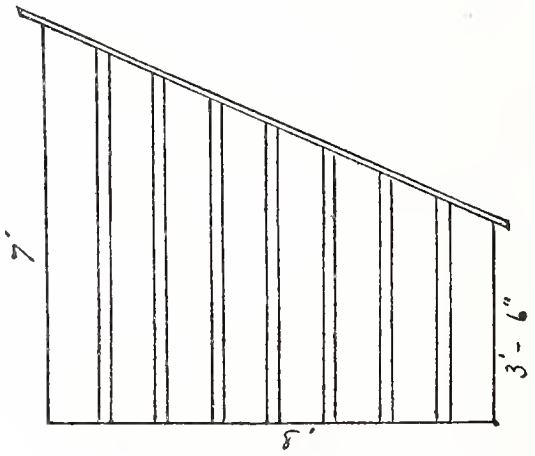
PLATE C.

PLATE D.

PORTABLE PENS.



Front view of portable pen.



End view of portable pen.

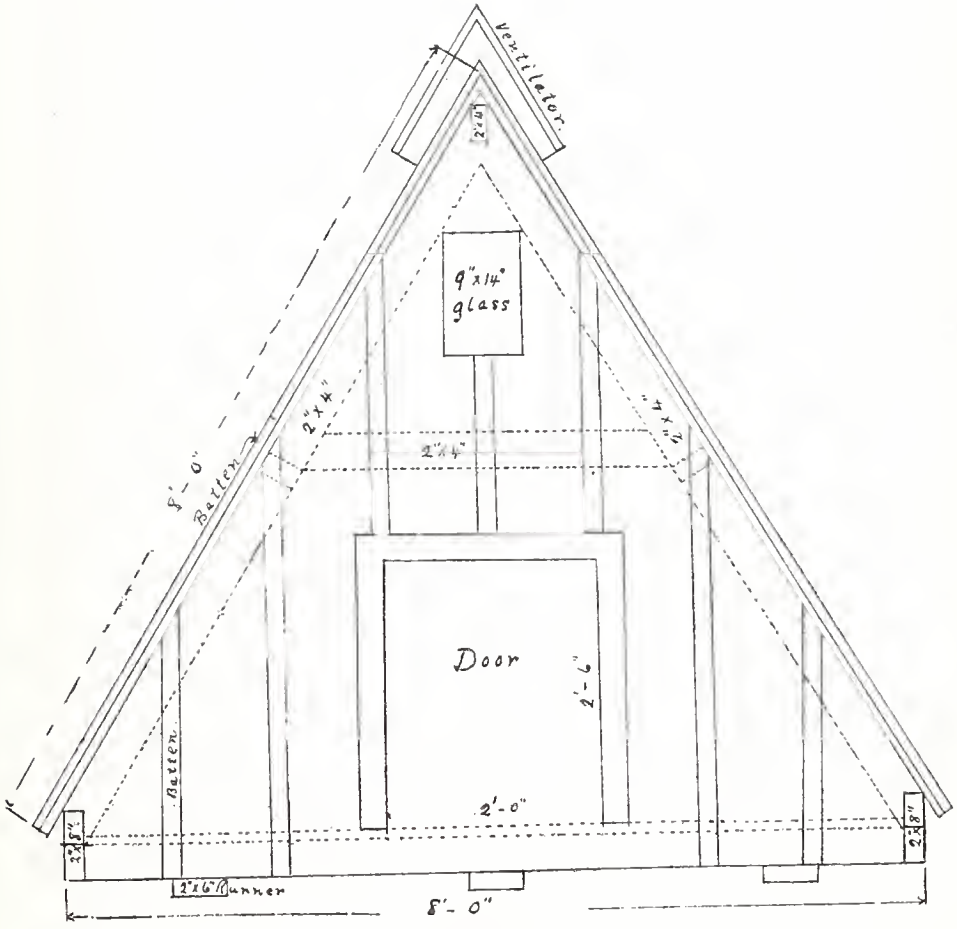

Ventilator
2"x4"
9"x14" glass
2"x4"
2"x4"
2"x4"
8'-0"
Batten
Door
2'-6"
Batten
2'-0"
2"x8"
2"x8"
2"x6" Runner
8'-0"

PLATE F.

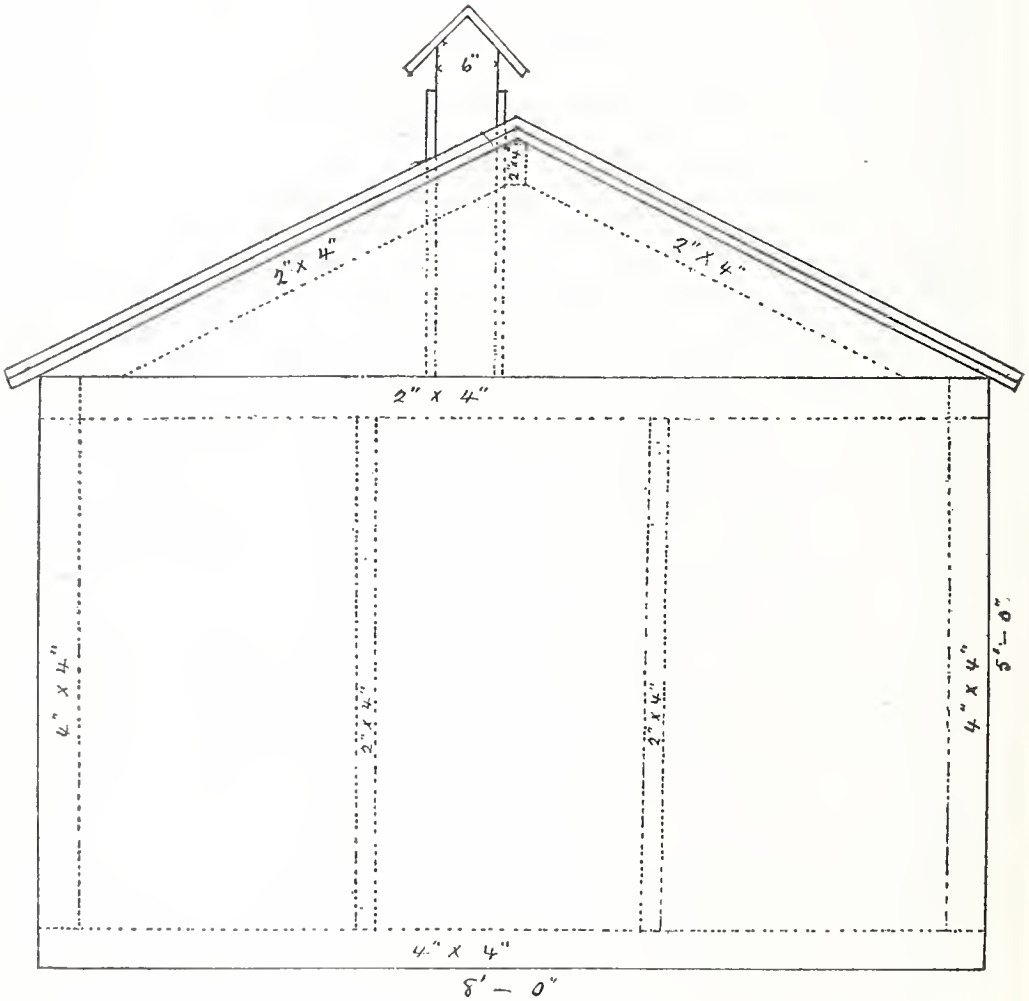
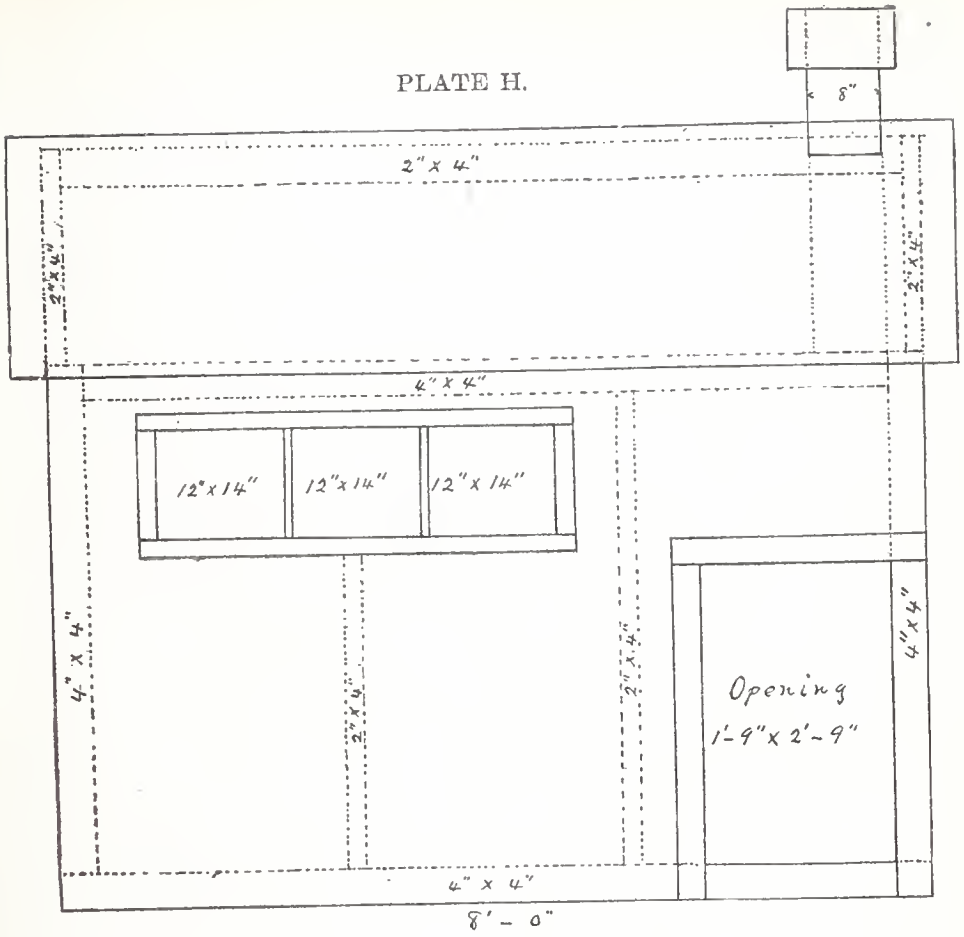


PLATE G.

PLATE H.



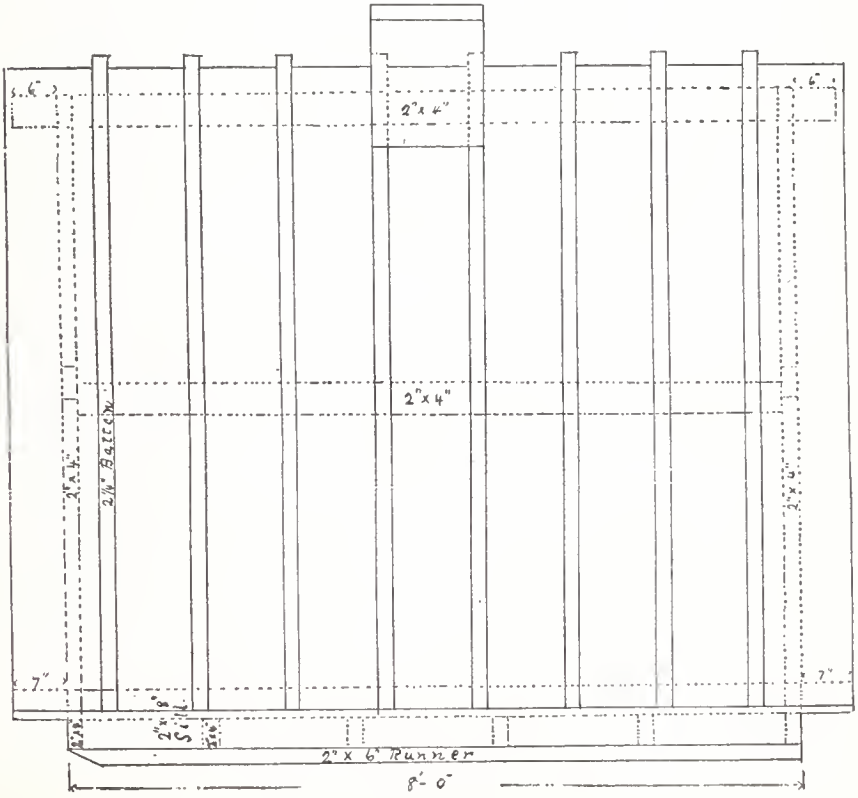


PLATE I.

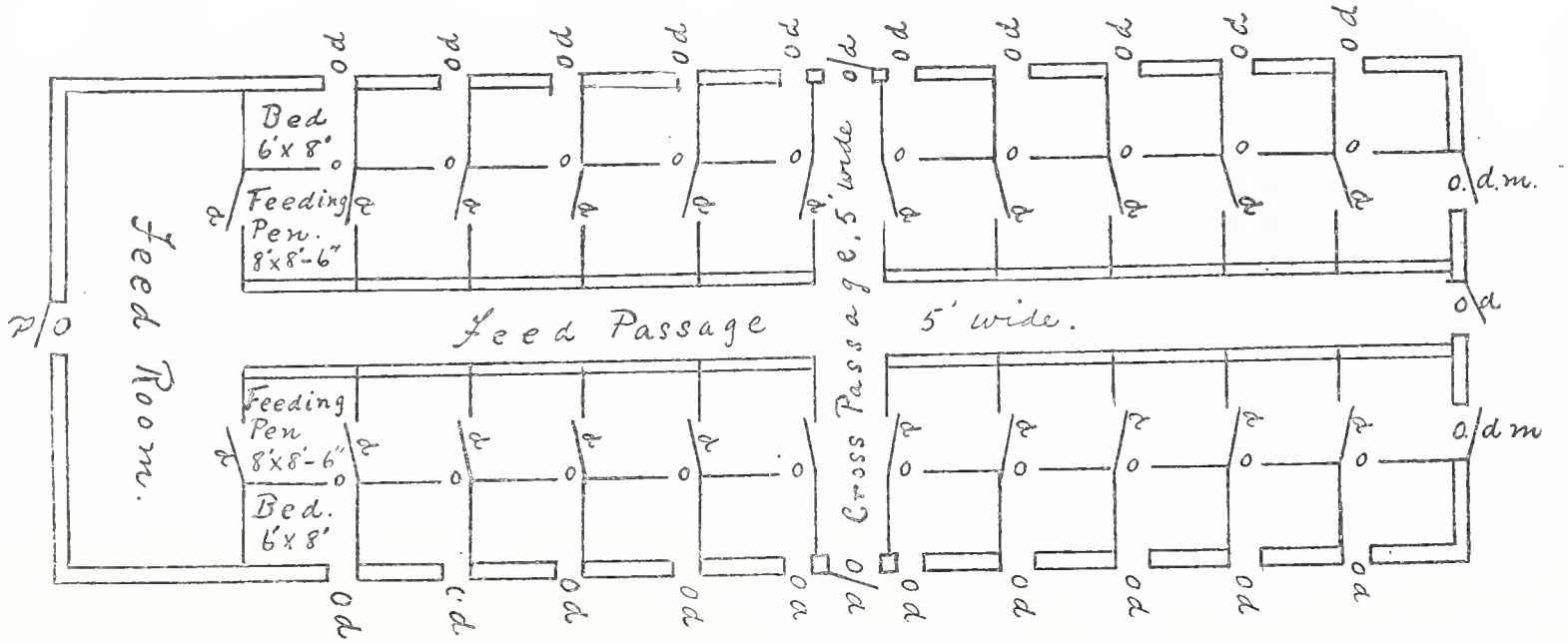


PLATE A.

EXPLANATIONS.—o. Openings 2½ feet wide between bed and feeding pen. d. Doors 4 feet wide in partitions, which swing back and fold openings at o. o. d. Doors leading outside. o. d. m. Doors for taking out manure or taking in bedding. Pens are uniform throughout. Dimensions of pens include partitions.

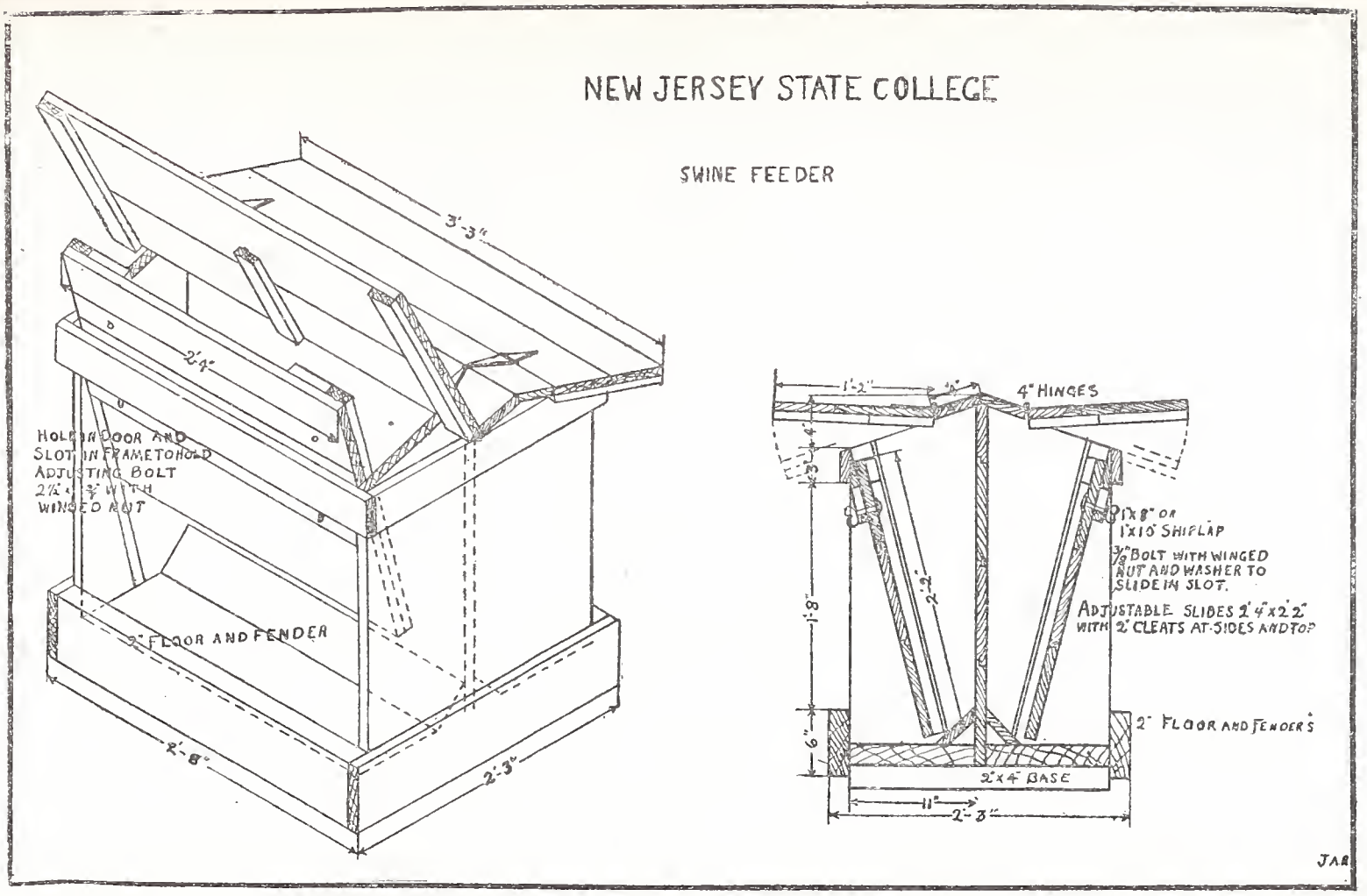


FIG. 16.—DETAILED PLANS FOR THE NEW JERSEY TYPE OF SELF-FEEDER.

A COMBINATION HOG HOUSE WITH HAY AND GRAIN STORAGE ROOMS.

It is a great convenience to have grain bins and storage room for bedding and hay in the hog house. In some houses similar to those described above such space has been provided by simply extending the building. A modification of the double house, which provides storage room and contains several other excellent features, is described below.

Figures 11 and 12 show the plans of a hog house built by a very successful grower of market hogs in western Iowa in 1906. It has now been in use four years and has given the owner excellent satisfaction. It contains 24 pens, each 5 by 9 feet, a covered feeding floor, bins for grain, tankage, and oil meal, and mow room for hay and bedding. The material cost, approximately, $400. The labor was all performed by the regular farm help and no account of it was kept. In this house a large number of hogs can be cared for with a very small amount of work. The high roof of the central part shuts off a portion of the sunshine from the sow pens. This is a bad feature, but one which could not be avoided without sacrificing the feeding floor and the convenience of the interior arrangement. This shading of the sow pens seems to the writer a very grave error, but the owner, after four years of experience, does not consider it very serious. Of course, even the pens next to the central part get the benefit of the sunshine somewhat more than half of the day. But it is evident that the windows nearest the central part of the building throw sunshine on the floor only a very short time. They would be much more useful if they were several feet from the high building. The owner now regrets that he did not make a solid row of windows both above and below.

Shed cots are used in connection with this house, the sows being moved out generally when the pigs are about two weeks old.

TWO TYPES OF CHEAP HOUSES.

Figure 13 shows a cheap house, but lacking in light and ventilation when the roof doors are closed. It is 6 by 48 feet and contains 8 pens, each 6 by 6 feet. The material (not including outside pens or posts) cost $48, or $6 a pen. Figure 14 shows the end elevation.

Figure 15 shows a much better house of the same general type. It contains sixteen 5 by 7 pens. The material cost (in southeast Nebraska, 1907) is $115, or $7.19 a pen.

HOG COTS OR INDIVIDUAL HOUSES.

Whether the large house with individual pens is better than the individual cot is an open question, perhaps largely a matter of individual preference. Each has its distinct advantages which can not be secured in the other. Many of the best hog raisers are now providing themselves with both types of houses, and this seems to be the most satisfactory method. It is no more expensive in the long run, for all the buildings can be kept in use the year round. In such cases the large houses are used for farrowing quarters, and as soon as the pigs are a week or two old, or as soon as the weather permits, the sows and litters are removed to the individual cots. During the remainder of the year the large houses are utilized for sleeping quarters.

The small cot has the advantage of keeping each sow from the disturbance of the others, and lessens the danger from contagious and infectious diseases. The disturbance in a large house, however, is usually not a serious matter and is often unduly emphasized. After the pigs get a little start there is usually more or less robbing where many are together.

The individual cot lessens this trouble. When the surroundings become insanitary, the cot can easily be moved to a clean place.

Probably the greatest disadvantage in the cot is the large amount of work required to tend the stock. This is a matter of no small importance. There are usually no windows, so there is no sunshine or light when the roof door is closed. There is, however, no reason why windows and ventilation should not be provided. The open roof which is commonly used places the pigs in more danger of being chilled by cold winds and sudden storms when the attendant is away. Unless the cot is unusually well built, it is somewhat more difficult to keep warm in very cold weather than the large house.

The main advantage in the large house lies in the convenience with which the stock can be tended and the short time required to see all the animals. It is somewhat more easy to keep warm, and is more easily heated if artificial heat is required. During cold days the pigs can get the sunshine, if there is any, without any exposure whatever.

The variety of individual hog houses is greater, if anything, than that of large houses, but they are readily separable into two general classes—the V-shaped cot, and the various cots with perpendicular sides. The V-shaped cot is quite satisfactory when well built and provided with a window and ventilating door, but generally these are lacking. Nearly all of the cots with perpendicular sides have doors in the roof or in the south side to be opened in sunny weather. It

is easier to care for sows in these houses than in the V-shaped cots. All cots should be built on skids. Some of the best types of cots are described below.

Figure 16 represents one of the best styles of V-shaped cots, commonly known as the Lovejoy cot. In 1904 the Nebraska Hospital for the Insane, at Lincoln, built a number of these cots. All the walls are double, being sheathed, papered, and then covered with flooring. The doors are also double. These cots cost about $40 each. Less substantial cots of the same shape may be built for much less money.

Figure 17 shows a good type of cot in use in southeastern Iowa. The whole south roof is on hinges and can be laid over on the north side. The front wall is a loose panel, which can be quickly removed. The floor is also removable. There are no projections on the ends in order that the cots may be set close together in winter. They are moved by raising and putting a sled underneath.

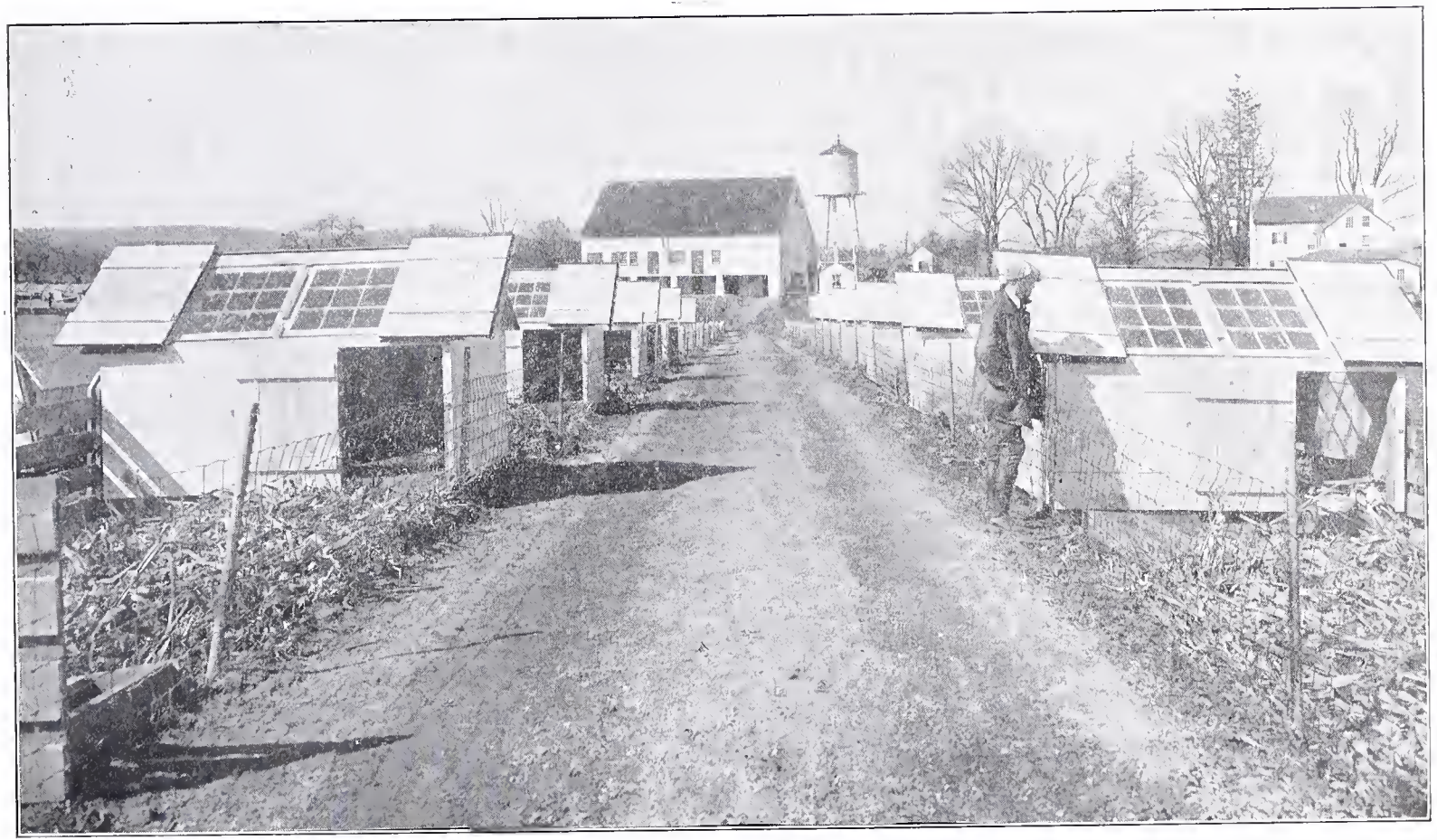
Figure 18 shows a good cot in south-central Nebraska, with a convenient knockdown pen. Skids 4 by 6, 9 feet long. Joists 2, 2 by 6, laid flat. Walls shiplap, paper and lap siding. Roof doors 18 inches wide. Cost complete, $25 (1908). Figure 19 shows the dimensions of the house and also the panels of the pen.

HINTS ON CONSTRUCTION.

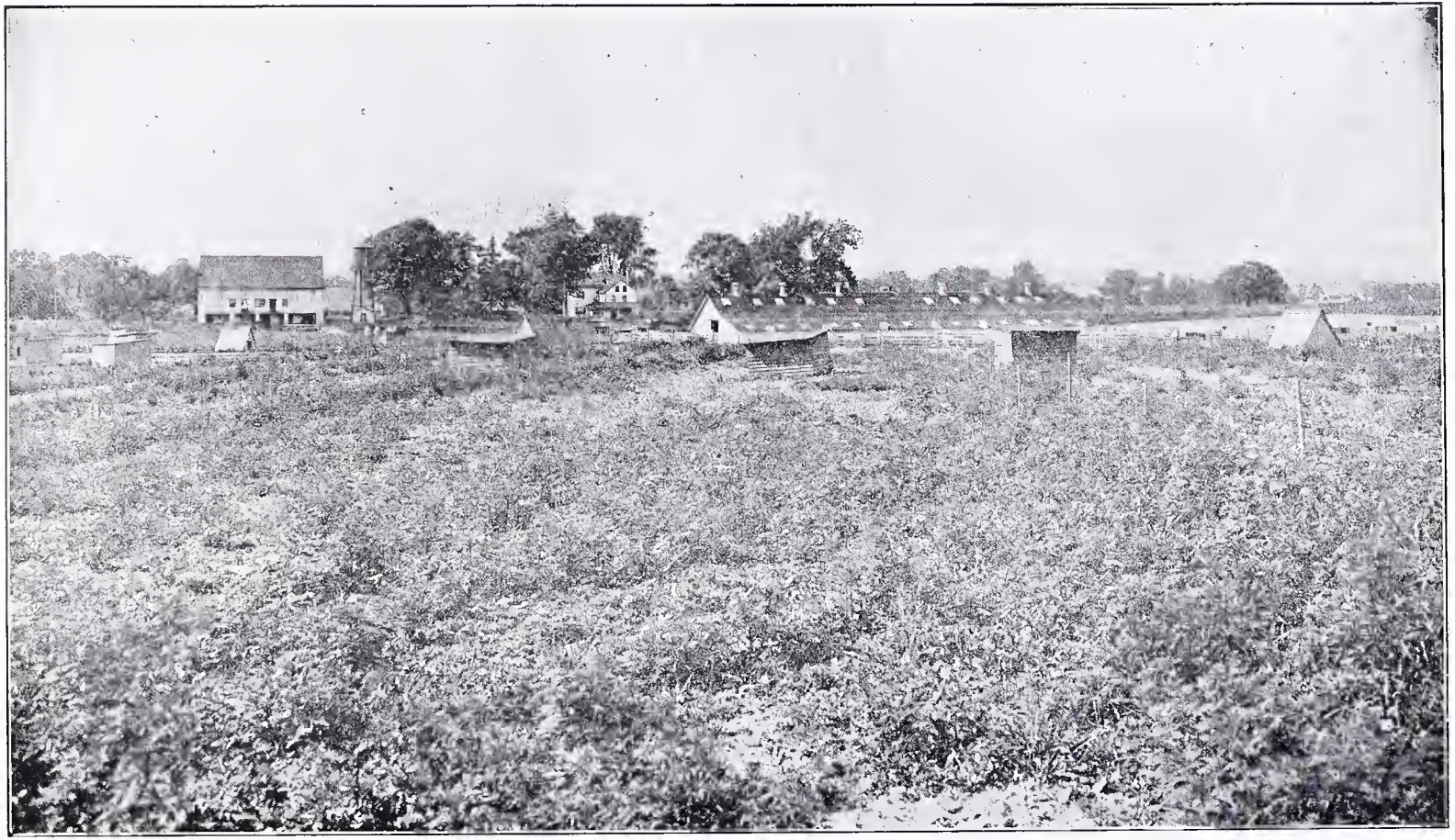
FLOORS.

The hog house floor is an unsettled question. A good floor is the ground with woven wire stretched on top to prevent the hogs from rooting. Electrically welded cornerib wire is very satisfactory. This makes a floor which is easy on the hogs, almost free from rats, and, if properly bedded, warm and dry. It is, however, more difficult to keep free of dust than some other floors. Many concrete floors are used, but they are cold, liable to be wet, and are hard on the hogs' feet. Often almost an entire pig crop and many sows are lost by taking cold on concrete floors. Concrete floors are, however, very satisfactory when covered with plank overlays, or false floors, which should be raised from the concrete about an inch by nailing cleats on the under side, as shown in figure 20. The wood portion of this floor consists of 2 by 4 inch timbers laid about one-fourth inch apart to allow drainage.

Board floors are expensive, short lived, cold if up off the ground, and make the worst kind of rat harbors. The writer once visited an old hog house with wood floor in which the owner said the rats



MODEL HOG FARM—COLONY HOUSES.
Courtesy Chester Valley Livestock Farm.



PERMANENT AND PORTABLE HOG BUILDINGS SHOWING METHOD OF RE-FORAGING.
Courtesy Chester Valley Livestock Farm.

DUROC-JERSEYS IN FORAGE.
Courtesy "The Country Gentleman."

PORTABLE FARROWING PEN.
Courtesy "The Country Gentleman."

had gotten over half the pigs. Several men report that rats may be kept out by packing sand or cinders to the top of the joists before laying the floor, but these materials are often too expensive to be used for this purpose.

PARTITIONS.

In making the inside partition, care should always be taken to have them perfectly tight at the floor and for about 10 or 12 inches above, so that young pigs can not crawl through, and so sows in the adjoining pens can not get hold of them and pull them through. A sow will often pull a newly born pig through under a partition and eat it, when, if the pig was in the pen with her, it would be perfectly safe. Above the first 10 or 12 inches it is better to have the partitions open enough so the hogs can see out, otherwise at every sound the sows will be up on the partitions to see what is going on.

Pig rails or guardrails should be placed on the inside of the pen, from 6 to 10 inches from the floor, according to the size of the sow, and should stand out 6 or 8 inches to prevent the sow from mashing the pigs against the wall.

It will be found convenient to have the alley gates removable by lifting out. It is sometimes helpful, also, to have part or all of the partition fences removable. All partitions should be 30 to 36 inches high.

Six by 8 feet is generally found to be a very satisfactory size for pens, but if feeding is to be done inside, the pens will need to be longer in order to give room to feed and water without getting the bed befouled. Very large sows, such as are sometimes kept by breeders, may need more room, but the producer of pork will not need a larger pen. Small sows do not need this much room, and it might be good economy to make half of the pens 5 feet wide. Five by 8 feet will accommodate a small sow very well.

Hog doors should be 22 to 23 inches wide and 30 to 31 inches high in the clear. In cold weather a piece of burlap or ducking hung at the top of the hog door, with a stick a little shorter than the width of the door nailed across the bottom to prevent the wind from blowing it back, will help materially to keep the pigs warm. The pigs will soon learn to lift the curtain when they want to go through. The board doors in cots would not then need to be closed except in very bad weather, or while the pigs are very small.

WHITEWASHING.

Whitewashing the inside of the house is an excellent practice. Besides going a long way toward disinfecting, it increases the light

materially. When the sunshine strikes a whitewashed wall, much of it is reflected to the floor and does a great deal of good. Dark houses which must be used will be much improved by whitewashing.

WHERE TO PLACE WINDOWS IN HOG HOUSES.

The following tables, prepared at the United States Naval Observatory, will enable the reader to determine at once how the windows in a hog house should be placed in order to secure the maximum sunshine in the pens at any desired time from January to May. The tables show the height (at top) necessary for windows to be in order that the sun may strike the back line of the floor of the pen—at the given distances north of the window—at 10 a. m., noon, and 2 p. m., on the first day of each month from January to May, inclusive. The calculations are made for every 2 degrees of latitude from 30 to 48 degrees north, and for distances north of the window from 4 feet to 18 feet. This covers all ordinary widths of buildings and all parts of the United States. It is assumed, of course, that the windows front due south.

The outline map of the United States (fig. 21) shows what parts of the country are crossed by each of the parallels mentioned in the tables. By referring to the map anyone can tell approximately what his lattitude is, and thus can see what figures in the tables apply to his locality.

HOW TO USE THE SUNSHINE TABLES.

Suppose a farmer lives at Springfield, Ill., and wishes to put up a hog house 20 feet wide, having pens 8 feet long and the alley 4 feet wide (after the general style of the houses shown in figs. 5 and 7), and wants the pigs to come about March 1. In this case the combined length of the pen and width of the alley (12 feet) represents the distance from the line of the upper windows to the back line of the rear pens. Consequently, in order to locate the proper height for the upper windows he turns to the table under "March 1," finds latitude 40, follows the line across to the column headed "12 feet," and there finds that the top of the window should be 10 feet 6 inches from the ground in order to get the sunshine on the back line of the pen at 10 a. m. and at 2 p. m. In this instance it will be noted that the sun, being a little higher at noon, does not quite strike the back line at that hour, but goes back there by 2 o'clock.

It may be seen from the above example that under normal conditions—that is, avoiding extremes of latitude and of season—the information given in the tables is of much practical value. Where however, we take Florida for May 1, or northern Minnesota for January 1, we find conditions that are not practicable, because in the first case the windows would have to be too high and in the second too low.

JANUARY 1.

Latitude.	Distance from window line (at floor) to north end of pen.																	
	4 feet.		6 feet.		8 feet.		10 feet.		12 feet.		14 feet.		16 feet.		18 feet.	
	Noon.	10 a.m. and 2 p.m.	Noon.	10 a.m. and 2 p.m.	Noon.	10 a.m. and 2 p.m.	Noon.	10 a.m. and 2 p.m.	Noon.	10 a.m. and 2 p.m.	Noon.	10 a.m. and 2 p.m.	Noon.	10 a.m. and 2 p.m.	Noon.	10 a.m. and 2 p.m.
	Height of window.															
	Ft. in.	Ft. in.	Ft. in.	Ft. in.	Ft. in.	Ft. in.	Ft. in.	Ft. in.	Ft. in.	Ft. in.	Ft. in.	Ft. in.	Ft. in.	Ft. in.	Ft. in.	Ft. in.
30 degrees N.	3 0	2 8	4 6	4 0	6 0	5 4	7 6	6 9	9 0	8 1	10 6	9 5	12 0	10 9	13 6	12 1
32 degrees N.	2 10	2 6	4 2	3 9	5 7	5 0	7 0	6 3	8 5	7 5	9 9	8 8	11 2	9 11	12 7	11 2
34 degrees N.	2 7	2 4	3 11	3 5	5 2	4 7	6 6	5 9	7 9	6 11	9 1	8 0	10 4	9 2	11 8	10 4
36 degrees N.	2 5	2 1	3 7	3 2	4 10	4 2	6 0	5 3	7 2	6 4	8 5	7 5	9 7	8 5	10 10	9 6
38 degrees N.	2 3	1 11	3 4	2 11	4 5	3 10	5 6	4 10	6 8	5 10	7 9	6 9	8 10	7 9	9 11	8 9
40 degrees N.	2 0	1 9	3 1	2 8	4 1	3 6	5 1	4 5	6 1	5 4	7 2	6 2	8 2	7 1	9 2	7 11
42 degrees N.	1 10	1 7	2 10	2 5	3 9	3 2	4 8	4 0	5 7	4 10	6 6	5 7	7 5	6 5	8 5	7 3
44 degrees N.	1 8	1 5	2 7	2 2	3 5	2 11	4 3	3 7	5 1	4 4	5 11	5 1	6 9	5 9	7 8	6 6
46 degrees N.	1 6	1 3	2 4	1 11	3 1	2 7	3 10	3 3	4 7	3 10	5 4	4 6	6 2	5 2	6 11	5 10
48 degrees N.	1 5	1 2	2 1	1 8	2 9	2 3	3 5	2 10	4 2	3 5	4 10	4 0	5 6	4 7	6 2	5 1

FEBRUARY 1.

30 degrees N.	3 8	3 5	5 7	5 1	7 5	6 10	9 3	8 6	11 1	10 2	13 0	11 11	14 10	13 7	16 8	15 4
32 degrees N.	3 5	3 2	5 2	4 9	6 11	6 4	8 8	7 11	10 4	9 6	12 1	11 1	13 10	12 8	15 6	14 3
34 degrees N.	3 3	2 11	4 10	4 5	6 5	5 11	8 0	7 4	9 8	8 10	11 3	10 4	12 10	11 9	14 6	13 3
36 degrees N.	3 0	2 9	4 6	4 1	6 0	5 6	7 6	6 10	9 0	8 2	10 6	9 7	12 0	10 11	13 6	12 4
38 degrees N.	2 9	2 6	4 2	3 10	5 7	5 1	6 11	6 4	8 4	7 7	9 9	8 10	11 1	10 2	12 6	11 5
40 degrees N.	2 7	2 4	3 10	3 6	5 2	4 8	6 5	5 10	7 9	7 0	9 0	8 2	10 4	9 5	11 7	10 7
42 degrees N.	2 5	2 2	3 7	3 6	4 9	4 4	6 0	5 5	7 2	6 6	8 4	7 7	9 6	8 8	10 9	9 9
44 degrees N.	2 2	2 0	3 4	3 0	4 5	4 0	5 6	4 11	6 7	5 11	7 8	6 11	8 10	7 11	9 11	8 11
46 degrees N.	2 0	1 10	3 0	2 9	4 0	3 7	5 1	4 6	6 1	5 5	7 1	6 4	8 1	7 3	9 1	8 2
48 degrees N.	1 10	1 8	2 9	2 6	3 8	3 3	4 7	4 1	5 7	4 11	6 6	5 9	7 5	6 7	8 4	7 5

MARCH 1.

Latitude.	Distance from window line (at floor) to north end of pen.																			
	4 feet.		6 feet.		8 feet.		10 feet.		12 feet.		14 feet.		16 feet.		18 feet.	
	Noon.	10 a.m. and 2 p.m.	Noon.	10 a.m. and 2 p.m.	Noon.	10 a.m. and 2 p.m.	Noon.	10 a.m. and 2 p.m.	Noon.	10 a.m. and 2 p.m.	Noon.	10 a.m. and 2 p.m.	Noon.	10 a.m. and 2 p.m.	Noon.	10 a.m. and 2 p.m.
	Height of window.															
	Ft. in.	Ft. in.	Ft. in.	Ft. in.	Ft. in.	Ft. in.	Ft. in.	Ft. in.	Ft. in.	Ft. in.	Ft. in.	Ft. in.	Ft. in.	Ft. in.	Ft. in.	Ft. in.
30 degrees N	5 2	5 0	7 9	7 5	10 4	9 11	12 11	12 5	15 6	14 11	18 1	17 4	20 8	19 10	23 3	22 4
32 degrees N	4 10	4 7	7 3	6 11	9 7	9 3	12 0	11 7	14 5	13 10	16 10	16 2	19 3	18 6	21 8	20 9
34 degrees N	4 6	4 4	6 9	6 6	9 0	8 7	11 3	10 9	13 5	12 11	15 8	15 1	17 11	17 3	20 2	19 5
36 degrees N	4 2	4 0	6 3	6 0	8 4	8 0	10 6	10 1	12 7	12 1	14 8	14 1	16 9	16 1	18 10	18 1
38 degrees N	3 11	3 9	5 10	5 7	7 10	7 6	9 9	9 4	11 8	11 3	13 8	13 1	15 7	15 0	17 7	16 10
40 degrees N	3 8	3 6	5 5	5 3	7 3	7 0	9 1	8 9	10 11	10 6	12 9	12 3	14 7	14 0	16 4	15 9
42 degrees N	3 5	3 3	5 1	4 11	6 9	6 6	8 6	8 2	10 2	9 9	11 10	11 5	13 7	13 0	15 3	14 8
44 degrees N	3 2	3 0	4 9	4 7	6 4	6 1	7 11	7 7	9 6	9 1	11 1	10 7	12 7	12 1	14 2	13 8
46 degrees N	2 11	2 10	4 5	4 3	5 10	5 8	7 4	7 0	8 10	8 5	10 3	9 10	11 9	11 3	13 3	12 8
48 degrees N	2 9	2 7	4 1	3 11	5 5	5 3	6 10	6 6	8 2	7 10	9 7	9 2	10 11	10 5	12 3	11 9

APRIL 1.

30 degrees N	8 4	8 7	12 6	12 11	16 8	17 3	20 10	21 7	25 0	25 10	29 2	30 2	33 5	34 6	37 7	38 9
32 degrees N	7 8	7 11	11 6	11 10	15 4	15 9	19 1	19 9	22 11	23 8	26 9	27 7	30 7	31 7	34 5	35 6
34 degrees N	7 0	7 3	10 7	10 10	14 1	14 6	17 7	18 1	21 1	21 9	24 8	25 4	28 2	29 0	31 8	32 7
36 degrees N	6 6	6 8	9 9	10 0	13 0	13 4	16 3	16 9	19 6	20 1	22 9	23 5	26 0	26 9	29 3	30 1
38 degrees N	6 0	6 2	9 0	9 3	12 0	12 4	15 0	15 6	18 1	18 7	21 1	21 8	24 1	24 9	27 1	27 10
40 degrees N	5 7	5 9	8 5	8 7	11 2	11 6	14 0	14 4	16 9	17 2	19 7	20 1	22 4	22 11	25 2	25 10
42 degrees N	5 2	5 4	7 9	8 0	10 5	10 8	13 0	13 4	15 7	16 0	18 2	18 8	20 9	21 4	23 4	24 0
44 degrees N	4 10	5 0	7 3	7 5	9 8	9 11	12 1	12 5	14 6	14 11	16 11	17 4	19 4	19 10	21 9	22 4
46 degrees N	4 6	4 7	6 9	6 11	9 0	9 3	11 3	11 6	13 6	13 10	15 9	16 2	18 0	18 6	20 3	20 9
48 degrees N	4 2	4 4	6 4	6 5	8 5	8 7	10 6	10 9	12 7	12 11	14 8	15 1	16 10	17 3	18 11	19 4

30 degrees N	14	11	17	7	22	4	26	4	29	9	35	2	37	2	43	11	44	8	52	8	52	1	61	6	59	6	70	3	67	0	79	0
32 degrees N	13	0	15	1	19	7	22	8	26	1	30	3	32	7	37	9	39	1	45	4	45	7	52	11	52	2	60	5	58	8	68	0
34 degrees N	11	7	13	3	17	5	19	10	23	2	26	5	29	0	33	1	34	9	39	8	40	7	46	4	46	4	52	11	52	2	59	6
36 degrees N	10	5	11	9	15	7	17	7	20	10	23	6	26	0	29	4	31	2	35	2	36	5	41	1	41	7	46	11	46	9	52	10
38 degrees N	9	5	10	6	14	1	15	9	18	10	21	0	23	6	26	3	28	3	31	7	32	11	36	10	37	7	42	1	42	4	47	4
40 degrees N	8	7	9	6	12	10	14	3	17	1	19	0	21	5	23	9	25	8	28	6	30	0	33	3	34	3	38	0	38	6	42	9
42 degrees N	7	10	8	8	11	9	13	0	15	8	17	3	19	7	21	7	23	6	25	11	27	5	30	3	31	4	34	7	35	3	38	11
44 degrees N	7	2	7	11	10	10	11	10	14	5	15	10	18	0	19	9	21	7	23	9	25	3	27	8	28	10	31	8	32	5	35	7
46 degrees N	6	8	7	3	10	0	10	11	13	4	14	6	16	7	18	2	19	11	21	10	23	3	25	5	26	7	29	1	29	11	32	8
48 degrees N	6	2	6	8	9	3	10	1	12	4	13	5	15	5	16	9	18	5	20	1	21	6	23	6	24	7	26	10	27	8	30	2

SANITATION AND HEALTH.

The hog is a difficult animal to treat when attacked by disease, and hence the breeder must adopt every means within his power to prevent disease from entering the herd. One can never be too careful in this matter, and the proverb: "An ounce of prevention is worth a pound of cure," is especially applicable in the management of swine.

Cleanliness.—Filth is an excellent harbor and breeding ground for disease germs. Care should be taken to have the pens cleaned frequently, and the pens should be so constructed that there are no places for filth to accumulate where it cannot be cleaned out. Water tight floors with as few cracks and corners as possible, together with adequate drainage, are important in a piggery.

Disinfection.—Every swine breeder or feeder should acquire the habit of using disinfectants freely. There are numerous proprietary or patent disinfectants upon the market, and, so far as the writer is aware, the well known ones are quite effective if used according to the directions accompanying them. Crude carbolic acid and creolin are excellent disinfectants. A five per cent. solution of either, or five parts of the disinfectant to one hundred parts of water, will be found effective for disinfecting pens. Chloride of lime is also good and is especially recommended by some for pens where cholera has existed. Five or six ounces of chloride of lime to a gallon of water makes an effective disinfectant.

In cases of infectious diseases, all bedding and manure should be removed and burned. Loose boards or planks should also be removed, and all adhering filth scraped off the floors, partitions, and troughs. It is little use applying a disinfectant on top of a coating of filth which may conceal and protect millions of disease germs. A good spray pump is best for applying the disinfectant, so as to force the liquid into every crack and cranny, and it is not wise to be economical in the use of the disinfectant. Every part of the pen should be thoroughly saturated with the solution.

If there are small outside yards attached to the piggery, they should be floored with cement, and then they can be disinfected in the same way as the interior of the building. If they are not floored, it is almost impossible to disinfect them thoroughly, and they are a constant menace to the health of the animals.

Pasture lots, and large paddocks or feed lots are more difficult to deal with. Liberal liming and plowing up is about all that can be done. In case of some diseases, such as cholera, it is safer to remove the hogs to other feed lots or pastures for at least several months. Of course, the lots could be disinfected by saturating the surface soil with a good disinfectant, but it would be an expensive operation.

Systematic disinfection of the premises should not be neglected even if there is no disease. A small spray pump and a constant supply of disinfectant to be used at frequent intervals about the buildings, constitute an important part of the equipment of a piggery. At least once a year, a general housecleaning is advisable, and white washing the walls, ceiling, and partitions with lime and crude carbolic acid will go a long way towards keeping the building sanitary. A good pint of crude carbolic acid of three gallons of whitewash will answer the purpose.

Quarantine.—Provisions should be made in large herds for quarters where hogs that have been purchased, or brought home from shows, can be kept entirely separate from the rest of the herd for at least three weeks. The plan of using portable pens and dividing the herd up into small groups, has a marked advantage over keeping the hogs in a large piggery, in case a contagious disease breaks out. With the portable pens, all hogs are not exposed, and it is a simpler matter to effect a quarantine.

Hog cholera is the most dangerous contagious disease that the swine breeder has to contend with. In case of an outbreak of either cholera or swine plague in the neighborhood, a most rigid quarantine should be put into force. There should be no visiting back and forth by either man or beast between infected farms and those which are clear, because the virus which causes the disease may be easily carried on the boots of the persons or the feet of animals. Even dogs have been known to carry the disease from one farm to another, and dogs are better to be tied up until an outbreak of this disease is under control.

On the farm where disease breaks out, healthy animals should be separated at once from the diseased animals, and different attendants should feed the two lots, each attendant keeping entirely away from the premises occupied by the hogs in charge of the other. Carcasses of hogs which die should be burned or buried so deeply that they are not likely to be dug up by dogs or other animals, and disinfection should be systematic and thorough.

Feeding for Health.—Feeding has been dealt within another place, but the importance of feeding in such a way as to maintain vigor cannot be too deeply impressed. Hogs which are fed in an injudicious manner have their vitality weakened and are more likely to contract disease than those which have been furnished a suitable ration.

Light.—Sunlight is a good disinfectant and an effort should be made to admit plenty of light into all pens. It must be remembered that disease germs flourish best in the dark.

Ventilation and Dryness.—To the difficulty of securing adequate ventilation in the piggery, may be traced a great many troubles which affect pigs. Rheumatism, bronchitis, pneumonia, and scours, the last mentioned being most common in young pigs, are among the commonest winter troubles of swine, and are generally caused by lack of ventilation and consequent dampness in the building. Unless ventilation is provided, and the pens kept reasonably dry, good results cannot be expected.

Lice.—When lice once become well established in a herd, it requires a good deal of painstaking effort to thoroughly eradicate them. They may be the cause of serious loss, and lousy pigs cannot give as good returns for food consumed as those which are kept clean. It is also claimed by good authorities that lice weaken the vitality of hogs and render them more susceptible to disease.

Almost any of the better known dips will prove effective if used according to directions. A two per cent. solution of creolin (2 parts creolin to 100 parts of water) makes a good dip for lice. Coal oil is very effective but is apt to blister, and should be applied lightly. Crude petroleum is also recommended by some.

In applying a dip, care must be taken to thoroughly wet all parts of the animal's body. Lice are commonly found on the inside of the legs, about the ears, or in the folds of the skin on any part of the body, and unless the application of dip is thoroughly made, many of them will escape. Dipping is one of the most effective methods, and when large numbers are to be treated, it is necessary to have a special dipping vat through which the hogs are compelled to swim. The dip may also be applied by means of a good spray pump, which forces the dip through the hair and into all crevices. It may also be applied by means of a broom, using a pail to hold the dip. By thoroughly brushing the dip into the hair, a very good job can be made.

When lice have been in a building for some time, it will be necessary to treat the building in practically the same way as recommended for disinfection, the disinfectants being also good insecticides.

In treating for lice, one application of insecticide is seldom sufficient, because there will be many eggs to hatch out to give a new brood. A second treatment, about a week after the first, should always be given, and a third treatment would not be out of place.

THE CAUSE OF HOG CHOLERA.

Hog cholera is a highly contagious disease of swine, caused by a germ or microorganism which is present in the blood, urine, feces, and the eye and nose secretions. It is accompanied by fever, has a high death rate, and, so far as known, does not affect other animals or man.

The germ has never been cultivated artificially in laboratories, as many other infectious germs have. It can not be seen, even with the most powerful microscopes; it passes readily through the pores of the finest filters, which will hold back all visible bacteria; and it is known only by the effects which it produces. In these respects it resembles the germs that cause foot-and-mouth disease in cattle and yellow fever in man. Although insanitary surroundings and improper feeding tend to lower vitality and thus perhaps render animals more susceptible to disease, such conditions can not of themselves cause hog cholera. It can be produced only by the specific microorganism referred to.

SYMPTOMS SHOWN BY HOGS SICK WITH CHOLERA.

The symptoms of hog cholera differ in different hogs and in different herds, depending upon the strength of the germs and the resisting power of the hogs. As a result of these variations the disease has been said to exist in two forms, acute and chronic, though the germ is the same in both. In the acute or severe type hogs sicken and die quickly, so that farmers will say that a hog which is found dead in the morning was well the night before. In the chronic or less severe type hogs may be sick for weeks or months before they succumb.

When cholera begins in a herd the hogs do not all become sick at once, but on the contrary only one or two will refuse to come up to feed with the herd. They will remain hidden in the nest (fig. 3) and when driven from the bed their backs may be arched and they may appear cold and shiver. The balance of the herd may remain apparently well for several days, when others are likely to be found affected in about the same way as those first attacked. As the disease progresses the sick hogs become gaunt or tucked up in the flank, and have a weak, staggering gait, the weakness being most marked in the hind legs.

If the lungs are affected there may be a cough, which is particularly noticeable when the hogs are disturbed. The eyes usually are inflamed and show a whitish discharge, which may cause the lids to stick together.

Constipation, which is commonly present in the early days of the disease, is generally followed by a diarrhea. As the disease reaches its height, red or purplish spots and blotches are likely to appear upon the skin of the ears, of the belly, and of the inner surfaces of the legs.

Some of the symptoms mentioned may be present in other diseases, but the owner should remember that cholera spreads rapidly through a herd and no time should be lost in undertaking to distinguish it from some other disease.

The temperature of the hogs is of much importance in diagnosing cholera. The normal temperature in ordinary weather when the hogs are not excited or worried will range from 101 to 104 degrees F., but when cholera is present it is not uncommon to find a large proportion of the hogs with temperatures from 104 to 107 degrees, and even higher.

PREVENTIVE MEASURES.

In view of the fact that when a hog shows the symptoms of hog cholera, which are visible to the eye, the tissues are usually so damaged that it is almost impossible to bring about repairs. Preventive measures must be instituted. In this connection it is important to realize that all breeds, without exception, are susceptible to the disease. In case breeding animals are purchased they should be quarantined for at least three weeks on the premises, and the shipping crates should be thoroughly disinfected, in order to make sure that disease is not invited or incurred from this source. The purchase of commercial manure or feed shipped in carload lots may prove a source of infection. Stock cars are often used for shipping these materials, and the proper precautions with respect to disinfecting and cleaning are not taken by either the railroad companies or the distributors. The traveling hog buyer or butcher in search of specimens for shipping or killing purposes has been known to spread the disease from farm to farm. It is essential that such visitors be kept outside of the feed lot. Exhibition at fairs is also a source of danger, and if cholera is prevalent in any district it should be insisted that all employees keep aloof from such premises. Runts or stunted animals should be promptly disposed of, as they are a constant source of annoyance, a standing invitation to disease, and either before or after an outbreak may be carriers or distributors. In case a service boar is offered for stud purposes there is considerable danger of infection. Neighbors may bring the disease to such premises and thereby endanger several herds in the community. Hog wallows should never be permitted in feed lots. Shade is far more essential than the dirty mudhole which is a constant source of danger, and always unsightly.

Healthy animals are naturally more resistant to the disease than animals possessing less vigor and vitality; therefore, every means should be employed that will establish sanitary premises and vigorous animals. The feeding utensils and equipment should be kept as clean as possible. The pens, sleeping quarters and yards should be regularly disinfected and the voidings promptly removed. Air-slaked lime prompts cleanliness and is a deodorizer. Any of the standard coal tar disinfectants that have germicidal properties may be used to advantage. Internal as well as external parasites and

pests should be destroyed without delay for they are a constant menace. In some of the oil districts crude petroleum is a domestic remedy for many ailments. It is often recommended for rheumatism, pneumonia, bronchitis, wounds and other ills, while the refined petroleum is a domestic remedy for coughs and colds. It is claimed by many that its use is a means of preventing hog cholera, but surely there is no evidence to substantiate the claim that it has any curative properties. It is an excellent antiparasitic. Whitewash, chloride of lime, compounds of creosote, crude carbolic acid, cresalis compound and other commercial disinfectants may be used to advantage. Muddy yards soon become filthy and endanger the health of the confined animals. The buildings should be located on well drained areas to avoid stagnant pools of assembled vermin.

ANTI-HOG CHOLERA SERUM.

Swine which have recovered from an attack of hog cholera develop a high degree of natural acquired immunity against further infection of this disease. Absolute immunity is unknown with this disease as well as with all other diseases; but cases are rare in which hogs suffer a second attack. A good type of sow which has acquired immunity will be valuable for breeding as a degree of immunity will be transmitted to her progeny.

Acquired immunity is produced in specially selected hogs for the manufacture of anti-hog cholera serum, by the injection of virus from the blood of a sick hog into the veins of the selected healthy hog. An immunizing dose of anti-serum is also administered. After recovery, the process is repeated until the injected animal becomes resistant to large doses of virulent blood. Such a hog is known as a "hyper immune" and its blood may then be used for the production of the anti-serum.

The various processes to which the serum is subjected render it sterile and the finished product is incapable of producing hog-cholera, or any other disease, if the approved method of administration is strictly followed. It is used as a prophylactic for the protection of apparently healthy hogs which have been exposed to infection. It is of no value as a curative in the advanced stages of the disease; but may have some value as such in the very early stage. The advisability of an early diagnosis and prompt administration of the remedial agents is apparent.

METHODS OF USES.

The anti-hog cholera serum may be used in two ways commonly known as the single and double treatments, also frequently referred to as the serum alone, and the sero-simultaneous methods. It is un-

lawful to use the double or sero-simultaneous method in Pennsylvania, except upon permit from, and under the supervision of the State Livestock Sanitary Board. The need for this restrictive legislation will be revealed in describing the double treatment.

The single treatment consists of injecting immunizing doses of anti-serum into hogs which have been exposed to hog cholera and are assumed to have received the infection. The theory upon which this treatment is based may be stated briefly as being an assumption of the presence in the anti-serum of the specific anti-bodies which will destroy the virus in the blood of the injected hog before the virus ravages the system or creates functional disturbances. It is again apparent that the single treatment must be given in the early stages of infection in order to obtain best results.

The anti-serum will not heal body tissues which have undergone degenerative changes through the action of the virus of the disease. It may destroy the virus but it cannot repair the damage and the animal will probably die as a result of functional disturbances of vital organs.

If the single treatment is used intelligently within its province of action, it will prove very effective in saving exposed hogs and checking the spread of hog-cholera.

In the absence of infection, the immunity conferred is of short duration, approximately three to six weeks. For this reason its use is not economical unless the hogs are known to have been exposed to infection. When the disease appears in a pen or drove of hogs, it may be assumed that all hogs in contact with the sick ones have received the infection. If the infected contact hogs are given the single treatment of anti-serum they will be immune to further attacks for varying periods up to one year, which will carry them to the usual period of slaughter. Thus the single treatment, if used in time, gives almost perfect results. The single treatment is advocated and urged by the State Livestock Sanitary Board: But it would be wasteful to use it unless the hogs have been exposed to infection.

If an owner observes symptoms which may indicate hog-cholera, he should immediately call a qualified veterinarian. If the diagnosis is positive to cholera, the veterinarian will notify the Board by telephone or telegraph, giving aggregate weight of exposed hogs. Serum will be promptly shipped to the veterinarian.

No charges are made by the Board for the serum or cost of transportation, but the services rendered by the veterinarian are at the expense of the owner.

THE DOUBLE TREATMENT.

This indicates the simultaneous use of the disease producing virus in connection with the preventive anti-hog cholera serum. It is based upon the assumption that the hogs are almost certain to acquire

cholera from natural infection at some period of their lives. The intent is to transmit the disease to them artificially, at the same time using the preventive serum to aid in a speedy recovery and thus make them immune to the natural infection when it arrives. This method is in vogue, and approved by the sanitary authorities of the middle western states where hog raising is an extensive industry. In these states hog cholera is almost constantly epizootic and hog owners realize the almost certainty that they will be visited by the scourge at frequent intervals.

In Pennsylvania the disease is on a different basis. Hog raising is not extensively practiced and the hog population is comparatively small. The disease has at all times been held under control by close co-operation of veterinarians with the State Livestock Sanitary Board. It has never assumed the proportions of a state wide epizootic. There have been a few extensive outbreaks involving fifty to one hundred farms in one or two counties but they have been quickly stamped out by the use of anti-serum, disinfection and quarantine restrictions. On the other hand there are counties in which the disease has never made its appearance. During the year 1917 there were but 3,986 deaths reported due to cholera. This comparatively small number can be greatly reduced in future reports if livestock dealers and hog-owners promptly report the appearance of cholera in their herds. Dealers holding public sales are chiefly responsible for the wide outbreaks of hog cholera.

If the unrestricted use of the double method of treatment should become prevalent in Pennsylvania it would mean that the entire State would gradually become polluted by hog cholera. This would necessitate the administration of the double treatment to all swine in whole communities and the process to be repeated on young pigs and newly purchased hogs, in order to protect them against the prevalent natural infection.

The injection of virus infects the hog with cholera; the injection of anti-serum assists nature to restore the animal to health. During the intervening period the sick hog is giving off the infection with the body excretions. The premises occupied, and the territory traversed by the hog become infected and remain as a menace to the community.

In order to protect the State against further spread of cholera, the Legislature very wisely enacted a law placing the use of the double treatment under the supervision of livestock sanitary authorities whose extensive experience with this disease gives them the knowledge necessary to intelligently enforce rules and regulations to govern the safe use of disease virus.

The hog farms best adapted for safe use of virus are those which utilize city garbage for feeding. They are invariably located in remote sections and maintained under conditions which practically eliminate the danger of spreading contagion from doubly immunized hogs.

DISTRIBUTION OF SERUM.

It is recommended that veterinarians or agents of the State Department of Agriculture trained for such service be engaged to administer the hog cholera serum. Indiscriminate distribution of the serum and its injection by inexperienced and unqualified men are bound to court dissatisfaction. With such a policy it is clear that vast amounts of serum would be wasted, and administered to swine suffering from ailments other than cholera. Under no circumstances will this Department distribute virus to laymen, nor will it authorize it administration by anyone other than experienced agents. This precaution is absolutely essential in order that the swine industry of the State may be promoted and protected.

MANAGEMENT OF TREATED HERDS.

Feed should be denied pigs intended for treatment during the twenty-four hours previous to injection. This will facilitate handling. Following injection the pigs should be confined and placed on half rations for three or four days. Corn should be omitted from the feed during this time, and the ration should be laxative and palatable. If it is impracticable to take temperature readings of all the animals treated, checks or controls should be selected, and their temperatures recorded during the period of treatment. In case a number of animals in the herd are afflicted with cholera and the well animals have been protected with serum, it is advisable to keep the sick hogs in the same pens with the well ones in order that the entire surviving herd may receive contact exposure, which will establish perpetual immunity. There is objection to administering the double treatment during excessively hot weather, as the excitement and shock are distressing. In case of an outbreak suckling pigs should be protected with small amounts of serum unless the dams are immune. Six weeks later, or after they have been weaned and fed on solid food for two weeks, they should be subjected to the double treatment. The serum alone is a harmless substance and can be used in almost any amount without harmful effects. The chief danger lies in not giving enough, as there is no danger in giving an overdose of fresh serum. Hog cholera virus, which is used with the serum in administering the double treatment, is an entirely different substance from hog cholera serum. It is the blood of an animal sick with the disease at the time the blood was drawn, and contains enormous numbers of germs of hog cholera

in the active stage of development. On this account the virus must be handled with extreme care, and only by skillful and experienced veterinarians.

TUBERCULOSIS.

The following extracts are quoted from a report issued by the United States Bureau of Animal Industry:

"Reports gathered from the various meat packing centers of the United States show tuberculosis of hogs to be on the increase, and causing heavier loss to raiser and packer alike than any other disease."

"Statistics show that several years ago there were over 56,000,000 hogs in this country, and their value at that time was over $339,000,000. Federal inspection at the abattoirs of the country show two per cent. of the hogs slaughtered to be affected with tuberculosis. More recent reports indicate that this disease is on the increase. This loss must ultimately be stood by the producers as the packers base the price they pay for hogs on the number of carcasses they must tank on account of disease. Reports from Europe show a far more widespread infection, that runs from 5.5 to 7.5 per cent."

"Hogs from Arkansas, Oklahoma, and Texas are remarkably free from tuberculosis, due to the methods of caring for them, or rather the lack of care. They are not restricted to feed-lots, where disease is commonly found, but roam over large areas to shift for themselves. No prolonged feeding is practised in narrow limits, but from birth to maturity they are pastured on alfalfa, oats, corn, rape, and peanuts. * * * In striking contrast are the hogs slaughtered at three cities in one of the leading dairy states where there is a large number of co-operative creameries, and the raw skim milk is fed."

"Buyers for packing houses are learning from bitter experience to avoid sections of certain states, and two firms will not buy hogs from one state known to be badly infected. In fact, many of the smaller packers in the Central West buy subject to post-mortem inspection, as a measure of self-protection."

"It is known beyond all doubt that the majority of tuberculous hogs are produced by the following causes:

1. Feeding raw milk and slime from creameries.
2. Feeding hand-separated milk from tuberculous cows.
3. Feeding behind tuberculous cattle.
4. Feeding tuberculous carcasses.
5. Feeding slaughter-house offal."

The quotations given show the importance of this disease, and the need for the farmer to be on his guard. It is a contagious disease and must be treated as such. The symptoms are not well marked, and a hog may be badly diseased and show practically no clinical symptoms. If the lungs are affected, the hog usually has a cough, and if the digestive organs are badly affected, there is generally indigestion, and general lack of thrift, but similar symptoms may show themselves with other disease, and it requires a great deal of experience to diagnose the disease with certainty.

Treatment is entirely preventive. Since the disease is usually communicated to hogs through their food, it is necessary to make certain that their food contains no germs. In dairy districts, the practice of sterilizing skim milk, buttermilk, and whey is to be commended, because dairy by-products constitute the main medium for transmitting the disease to hogs. Sanitary surroundings, pure food and fresh air are the feeder's main safeguards in connection with this dangerous disease.

INDIGESTION.

Indigestion in various forms is caused by mistakes in feeding. Over-feeding and lack of exercise will sometimes bring on the trouble, or the feeding of swill containing injurious substances, such as washing powders, is apt to cause derangement. In the acute form, it causes the animals a good deal of pain, causing it to arch its back and give evidences of suffering. In such cases it is well to have a veterinarian prescribe for the trouble.

The chronic form sometimes follows an attack of acute indigestion, causing an unthrifty, stunted condition of the animal. Perhaps the best home remedy is a dose of castor oil, followed by careful feeding upon easily digested foods. If the trouble is not relieved, a veterinarian had better be consulted. Prevention is better than cure, and when a pig once become badly stunted, it is difficult to ever make it pay for its food.

DIARRHOEA IN YOUNG PIGS.

This trouble is very often due to damp, chilly pens, and may also result from a feverish condition of the mother, which sometimes results from injudicious feeding after farrowing. If the trouble is due to the sow, a dose of two or three ounces of castor oil given to the sow will help allay the fever. Two or three teaspoonfuls of tincture of opium administered to the sow will help check the diarrhoea. If the trouble is due to the pen, no relief need be expected until the surroundings are improved.

BRONCHITIS.

Bronchitis commonly attacks young, growing pigs, and may be caused by dust, lung-worms, or damp, chilly quarters. A distressing cough, especially when disturbed from their bed, is one of the most important symptoms. Many of the pigs become unthrifty, and if the disease attacks very young pigs, it is likely to cause death.

Dry, comfortable quarters, and nourishing food will often pull the pigs through, and care should be taken in making the pens and yards sanitary before any more young pigs are put in them.

PNEUMONIA.

Pneumonia is more serious than bronchitis and frequently causes death in a very short time. It often results from a severe cold, and

may also be brought on by overexertion, such as being chased, or driven at too rapid a rate. Damp and unsanitary conditions in the pen may also be a cause. A cough, fever, and hurried or labored respiration are among the symptoms.

About all the farmer can do is to aim to prevent the disease. If he has a case to deal with, careful nursing is the main thing. Comfortable, well ventilated quarters, and a light sloppy diet are important. Daily doses of castor oil will help keep the bowels active, and if the weather is cold, the animal had better be kept covered with a blanket. Treatment is not very satisfactory, as it is difficult to nurse a very sick pig.

THUMPS.

This disease is caused by a disordered digestion which irritates the nerves connected with the diaphragm, causing sudden contractions of the diaphragm at irregular intervals. The contractions or spasms of the diaphragm cause a jerking movement of the flank, which is a characteristic symptom of the disease. The pig becomes unthrifty and stunted, and very young pigs are likely to succumb or to become practically worthless.

Too liberal a supply of food and too little exercise will often bring on the trouble. Young pigs often contract the disease before they are weaned if they have a good mother and are not given much exercise, and it is usually the finest and fattest pig in the litter which is the first to go wrong.

Treatment is mainly preventive, and hence the necessity for providing exercise for young pigs, especially if their mother is a liberal milker and the pigs become very fat. Judicious feeding and exercise will entirely prevent the disease, and if a case occurs, it is a signal that a change in methods should be made at once. Sometimes it is difficult to obtain exercise for young pigs in cold weather, and some recommend shutting them in a pen away from the mother for an hour or so twice a day. As a rule, this plan will stimulate the laziest of them to taken considerable exercise.

INFLAMMATION OF THE UDDER.

Heavy milkers are most liable to this trouble, but whatever the cause, the disease calls for prompt treatment. Dr. R. R. Craig, in his excellent book, "Diseases of Swine," recommends the following treatment.

"Milking the sow's udder two or three times a day will usually relierelieve its congested condition. A physic of Epsom salts should be given every other day, and a sloppy diet fed. In case the udder becomes inflamed, it should be kneaded gently with the fingers, and the following ointment applied daily: Extract of belladonna and gum camphor (one dram of each), and vaseline (three ounces). Hot fomentations may also be used."

"Sore teats should be bathed daily with white lotion (one part zinc sulphate, three-fourths of a part lead acetate, and thirty parts water) until healed."

ECZEMA.

Eczema, and similar skin troubles, can usually be successfully treated by washing or spraying with a one per cent. solution of creolin, or some of the well known tar disinfectants. The hog should be kept in a clean, dry place, and out of the sun until cured. It sometimes requires time to effect a cure, and the treatment should be given every day until the disease is conquered.

RHEUMATISM.

In northern latitudes, rheumatism often occurs among swine, especially during cold, damp weather. Damp, ill-ventilated pens are a common cause, and it may sometimes be caused by over-feeding. Piggeries built with stone or concrete walls are generally more dangerous than those built of wood.

The hog becomes very lame and stiff, and moves about with difficulty. Sometimes the joints become swollen and very painful, and the animal becomes practically helpless. In such cases, it is seldom that the hog makes a recovery.

The feeder must be on his guard against this disease. Dry, well ventilated pens and careful feeding will generally enable him to avoid disaster. Animals which become affected should be kept in dry, warm quarters. Dr. Craig (Diseases of Swine) says: "Salicylate of soda is the most useful drug to give in this disease. The dose is twenty or thirty grains in the feed, or as a drench, three times a day. Larger doses, and at more frequent intervals, may be given in acute cases for a short time. Quinine and bitter tonics can also be given. Blistering ointments and liniments should be applied to the inflamed articulations."

INFECTIOUS SORE MOUTH.

This disease is quite common in small pigs from a few days to several weeks old. It is caused by a germ, and filthy quarters and damp, muddy yards favor the development of the disease.

One of the first symptoms is a disinclination to suck on the part of nursing pigs, or a falling off in appetite in older pigs. The lining membrane of the mouth becomes inflamed, and sometimes the snout and lips become swollen. Later, ulcers form, often involving the lips and snout.

Dr. Craig recommends the following treatment:

"As soon as the disease breaks out in a litter, both the mother and pigs should be removed from the herd. The affected pigs can be treated by dipping head foremost into a four per cent. water solution of some reliable tar disinfectant; or permanganate of potassium,

one ounce to a gallon of water can be used. A more thorough way to treat them is to wash out the mouth by injecting the solution directly into it with a syringe. It is advisable to use this method wherever practicable, and especially in advanced cases. It is also advisable to clean the ulcerated parts by scraping away the dead tissue and rubbing the surface of the ulcer with lunar caustic. The above treatment should be repeated twice a day in advanced cases, and in mild ones once a day. It should be kept up for as long a time as necessary. It is usually more economical to kill the badly diseased pigs than it is to treat them, as they are apt to scatter the disease and become badly stunted and deformed."

If treatment is adopted upon the first appearance of trouble, the disease is not as difficult to cure.

INTESTINAL WORMS.

Common Round Worm.—The most common intestinal worm affecting swine is the round worm which is found mainly in the small intestine. If a post-mortem examination is made some time after death, the worms may be found in the stomach, having made their way there after the death of the animals. The worms vary from six to eleven inches in length, and taper somewhat towards the extremities. In color, they are usually a yellowish white. The eggs of the female pass out with the excrement and become scattered over the premises. Eventually, some of them are taken up by other hogs along with their food.

They do not seem to cause the hog any inconvenience unless they are present in very large numbers, when they may cause digestive troubles, and the writer has known death to result. There can be little doubt, however, that a pig affected with worms cannot make the best use of its food, even though it may appear quite thrifty.

Thorn-Headed Worm.—This parasite is much less common than the round worm. It is usually found attached to the wall of the intestines by its hooked proboscis from which it derives the name of "thorn-headed." In length, it is similar to the round worm, but its surface is somewhat wrinkled, and the posterior extremity is blunt. Though only a few are usually found in an animal, they do much more damage than the round worm, irritating the lining of the intestine, and sometimes causing severe inflammation. It would be difficult to distinguish the symptoms from other intestinal derangements, but a post-mortem examination would readily reveal the presence of the worm.

Pin Worm.—The pin worm is very small and might be easily overlooked in a careless post-mortem. It is usually found near the beginning of the large intestine, often hidden in the folds of the lining membrane. It is a very common parasite of swine, and does not seem to cause much inconvenience to the animal.

Whip Worm.—This is also a small worm, being about one and one-half inches long. It attaches its head to the lining of the intestine, and is usually found in the beginning of the large intestine. The anterior portion is very thin and hair-like, and the posterior portion is thick and cylindrical in shape. Like the pin worm, it does not seem to create much disturbance, but must be more or less injurious.

Treatment of Intestinal Worms.—Preventive treatment consists in keeping buildings and surroundings clean and sanitary. Feeding in filthy yards, and allowing to drink stagnant water, are practices which favor the spread of parasites.

As to medicinal treatment, the writer has found that allowing hogs access to a mixture of charcoal and salt, or charcoal, wood ashes, and salt, seems to be quite effective in driving out round worms.

Turpentine is commonly recommended for worms, especially the thorn-headed worm. The dose is a teaspoonful for every eighty or one hundred pounds live weight of the hogs to be treated. It can be given in the food, and the hogs should be fasted at least twelve hours before treatment. A dose each day for three days will generally prove effective.

Another remedy which is recommended is five grains of calomel and ten grains of santonin for every hundred pounds live weight of the hogs. This remedy can also be given in the food. It is generally advisable to give a physic after treatment for worms.

LUNG WORMS.

The lung worm is a small, thread-like, whitish colored worm, sometimes found in large numbers in the air passages of the lungs. Ordinarily, about the only symptom is a spasmodic cough, which is somewhat similar to the cough which accompanies bronchitis. Sometimes the irritation caused by the worms produces inflammation and consolidation of the lung tissue, in which case the animal dies, but in many cases no bad effect is apparent. In a post-mortem examination, the worms can be detected by cutting the lung near the apex, and then squeezing the tissue next to the cut. The pressure forces the thread-like worms out upon the cut surface.

There is practically no effective treatment for this parasite. Clean pens, in which disinfectants are liberally used, and clean, well drained yards will help keep the worm in check. Filthy yards and wallows favor its development. Ploughing up old bog lots, liming and reseeding them is also a preventive measure.

OTHER DISEASES.

The diseases mentioned above are those most frequently encountered. There are others to which swine are subject, but mostly

of less serious importance. An opinion is held by many persons that the hog is more resistant to diseases, other than those of a specific nature, than other domestic animals. This may be more apparent than real. In the days of six cent pork, a sick hog on the farm was not considered of sufficient importance to warrant the expense of expert veterinary attendance; in fact, there was such small demand for services of this nature that veterinarians in general were not well prepared to handle diseases of swine. That era is past, probably never to return and an epochal period of high priced pork is at hand. Every effort should be made to conserve and increase the hog population.

The hog is a difficult animal to treat for disease and our efforts for conservation should be directed mainly to keeping disease out of the herds and using prompt measures to prevent spreading when it does appear. It should be the practice on every farm to conduct careful post-mortem examinations on every animal that dies from unknown causes; especially so, if other animals are showing symptoms similar to those exhibited by the deceased.

If there is any doubt as to the diagnosis from the post-mortem examinations, the organs or tissues which appear abnormal may be sent to the laboratory of the State Livestock Sanitary Board at 39th Street and Woodland Avenue, Philadelphia, for detailed pathological examinations. Care should be taken to pack all such specimens securely with sufficient ice to prevent degenerative changes before arrival. They should be accompanied by a letter giving all available information regarding the animal from which taken, in so far as it relates to the history of the symptoms exhibited and manner of death.

The Pennsylvania Department of Agriculture and the State Livestock Sanitary Board exist for the purpose of helping the farmer and the officials and employees will gladly render any service within their jurisdiction to help him overcome his difficulties.

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